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ABSTRACT

Mathematics alternative assessment continues to be a hot topic with much activity on development, standards setting, and relation to reform. This document defines alternative assessment as any assessment in which students construct a response to a question rather than choosing a response from a list. This annotated bibliography contains the articles representing Assessment Resources Library (ARL) holdings to date in the area of assessment alternatives in mathematics. Articles are included that stimulate thinking, provide ideas, and include actual assessment instruments as well as related articles on such topics as the impact of alternative assessment, portfolios, multiple intelligences, and electronic resources. All grade levels are represented as are both classroom and large-scale assessments and commercial and local efforts. An index is included. (Author/ASK)

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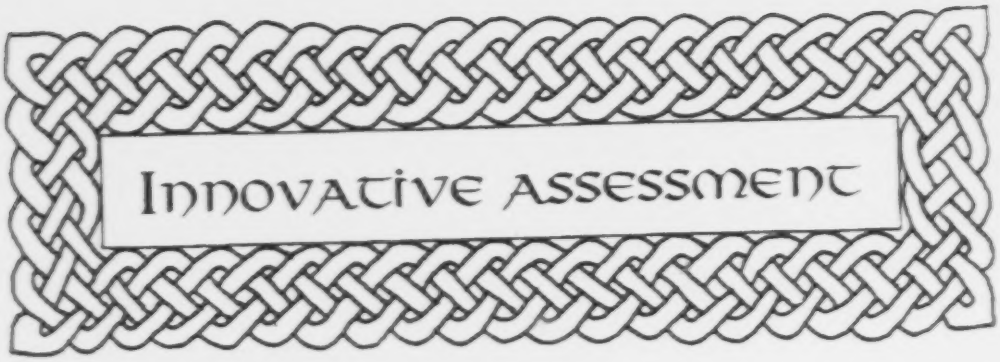

BIBLIOGRAPHY OF ASSESSMENT ALTERNATIVES:

MATHEMATICS

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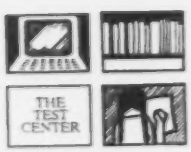

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Innovative Assessment

Bibliography of Assessment Alternatives: Mathematics

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BIBLIOGRAPHY OF ASSESSMENT ALTERNATIVES: MATHEMATICS

January 1998

Mathematics alternative assessment continues to be a hot topic, with lots of activity on development, standards setting and relation to reform. We define alternative assessment as any assessment in which students construct a response to a question rather than choosing a response from a list. The following articles represent Assessment Resources Library holdings to date in the area of assessment alternatives in mathematics. Presence on the list does not necessarily imply endorsement; articles are included to stimulate thinking and provide ideas. They include actual assessment instruments, as well as related articles on such topics as: the impact of alternative assessment, portfolios, multiple intelligences, and electronic resources. All grade levels are represented, as are both classroom and large-scale assessments, and commercial and local efforts. There is an index at the end of this bibliography to help users find articles of interest. For more information, contact Matthew Whitaker, Assessment Resources Library Clerk, at (503) 275-9582, Northwest Regional Educational Laboratory, 101 SW Main, Suite 500, Portland, Oregon 97204, e-mail: arl@nwrel.org. To purchase a copy of this bibliography, please call NWREL's Document Reproduction Service at (503) 275-9519.

Alper, Lynne, Dan Fendel, Sherry Fraser, et al. ***Various documents on the Interactive Mathematics Program (IMP)*****, 1993-94. Available from: EQUALS, Lawrence Hall of Science, University of California, Berkeley, CA 94720, (510) 642-1910, fax (510) 643-5757. Information also available from: Linda Witnov, IMP Outreach Coordinator, 6400 Hollis St., Suite 5, Emeryville, CA 94608, (510) 658-6400.**

This document includes several papers about the Interactive Mathematics Program which:

- Discuss the philosophy guiding the program
- Provide examples of instructional activities, including "Problems of the Week" and student self-reflection

- Report evaluations of the impact of the project on students; impact was measured by the SAT and two attitude measures (which are included); (no performance assessment was used as an outcome measure; the performance assessments described in the materials include tasks but no performance criteria)

Some sample student work is included.

(AL#500.3VARIMP)

Ann Arbor Public Schools. ***Alternative Assessment—Evaluating Student Performance in Elementary Mathematics*****, 1993. Available from: Dale Seymour Publications, PO Box 5026, White Plains, NY 10602, (800) 872-1100, fax: (800) 551-7637. Internet: www.aw.com/dsp/**

This book is the result of a project in the Ann Arbor Public School System to help teachers expand their use of alternative assessment techniques. The first part of the book includes information on performance indicators (including rubrics) and general information on assessment. The second section (the vast majority of the book) presents over 100 assessment tasks for grades K-6. The section on performance indicators is outstanding. Assessment approaches include interviews (oral communication), observation, portfolios, student self-assessment, performance tasks, and student writing. Advice and examples in the sections on interviews, portfolios, and performance tasks.

All tasks come with rubrics, some of which are task-specific and some of which are general, depending on the nature of the outcome being assessed. Student work is included. No technical information is included.

(AL#500.1ALTASE)

Annenberg/CPB Math and Science Project, The. ***What Should I Look for in a Math Classroom?*****, undated. Available from: The Annenberg/CPB Math and Science Project, (800) 965-7373.**

This brochure for parents contains a checklist of what to look for in a math classroom - what students and teachers should be doing. It is based on current models of sound math instruction. No technical information is included.

(AL#100.4WHASHL)

Appalachia Educational Laboratory. ***Alternative Assessments in Math and Science: Moving Toward a Moving Target,*** **1992. Available from: Appalachia Educational Laboratory, PO Box 1348, Charleston, WV 25325, (304) 347-0400.**

This document reports a two-year study by the Virginia Education Association and the Appalachia Educational Laboratory which twenty-two K-12 science and math teachers designed and implemented new methods of evaluating student competence and application of knowledge. Teachers who participated in the study felt that the changes in assessment methods led to changes in their teaching methods, improvements in student learning and better student attitudes. Instruction became more integrated across subjects, instruction shifted from being teacher-driven to being student-driven, and teachers acted more as facilitators of learning rather than dispensers of information.

Included in the report is a list of recommendations for implementing alternative assessments, a list of criteria for effective assessment, and 22 sample activities (with objectives, tasks, and scoring guidelines) for elementary, middle, and high school students, all designed and tested by the teachers in the study.

Most activities have performance criteria that are holistic and task-specific. Some are on the skimpy side. No technical information or sample student work is included.

(AL#600.3ALTASM)

Artzt, Alice F., and Eleanor Armour-Thomas. ***Evaluation of Instructional Practice in the Secondary School Mathematics Classroom.*** **Paper presented as part of a symposium at the Annual Meeting of the American Educational Research Association, New York, April 1996. Available from: Author, Queens College of the City University of New York, Mathematics Dept., 65-30 Kissena Blvd., Flushing, NY 11367, (718) 997-5169.**

The author reports on a study in which 14 lessons by 4 teachers were rated for quality and then teachers were interviewed on such things as their knowledge, beliefs, padagogical awareness, monitoring student understanding, and clarity of learning targets for students. Results showed that good quality lessons were associated with knowledge, beliefs and goals focused on student learning with understanding. Poor quality lessons were associated with teacher knowledge that was fragmented, goals that were limited to isolated performance outcomes for students, and beliefs that were not well articulated. The rating forms for lesson quality and teacher thoughtfulness are included.

(AL#500.6EVAINP)

Bagley, Theresa, and Catarina Gallenberger. ***Assessing Students' Dispositions: Using Journals to Improve Students' Performance.*** **Located in: The Mathematics Teacher 85, November 1992, pp. 660-663.**

The authors discuss the use of journals to elicit student behavior that can be examined for high school student attitude toward math, ability to make mathematical connections, and understanding. They present many questions, tasks, and instructions for getting students to self-reflect, and provide good, practical suggestions for managing the process. However, the authors do not provide criteria for examining student responses—what to look for in responses that are indicators of attitude, connections or understanding. Therefore, the papers will beuseful only to the extent that users have the expertise to know what to look for in responses.

(AL#500.6ASSSTD)

Balanced Assessment Project. ***Balanced Assessment for the Mathematics Curriculum*****, 1996. Available from: Sandra K. Wilcox, Project Director, Department of Teacher Education, 509B Erickson Hall, Michigan State University, East Lansing, MI 48824, e-mail: wilcoxs@msu.edu**

Balanced Assessment in Mathematics, according to the authors, has the following features:

- Assesses the math that counts
- Is fair to the curriculum
- Is of high quality (has instructional value)
- Provides useful information

Fairness to the curriculum means that all areas of math are covered, as are reasoning, problem solving, and communication. Balance includes various task types.

Each task package contains 10-20 tasks of various emphases, lengths (5-45 minutes) and types. Each task includes an overview, task prompt, sample solution, information on using the task, and descriptions of characteristic student responses. At least two task packages are available at elementary, middle, and high school, plus a "senior assessment package."

All scoring is task specific, but there is such a wealth of ancillary descriptive material, that it is easy for the teacher to see what is being assessed and the general qualitatives of work that make it successful.

This is a good one—the philosophy is right, the materials are of good quality, and the classification scheme for tasks is useful.

All of this makes for great assessment. As for the instructional end, the tasks themselves build skills. But the self-reflective component is missing, including generalized student-friendly rubrics that students can use to self and peer assess. Where, for example, is the rubric that describes the features of sound communication, in general? No technical information is included.

(AL#500.1BALASS) IN-HOUSE USE ONLY

Baxter, Gail P., Richard J. Shavelson, Sally J. Herman, et al. ***Mathematics Performance Assessment: Technical Quality and Diverse Student Impact.*** **Located in: Journal for Research in Mathematics Education 24, 1993, pp. 190-216.**

The authors developed 41 hands-on tasks to measure three categories of sixth-grade student competencies: measurement (seven tasks), place value (31 tasks), and probability (three tasks). An example of a measurement task is "describe the object," in which students write a description of an object that someone else could use to draw the object. An example of a probability task was "spin it" in which students were given a spinner with eight sections (four orange, three yellow, and one green). They had to predict which color the pointer would land on most or least often, predict the outcome of 32 spins, carry out the experiment, and graph the results.

Responses were scored either by degree of "correctness" or, in the case of the communication items (e.g., describe an object), holistically for general quality of the response. The tasks and criteria are described only in general terms; further information would have to be obtained from the authors in order to actually reproduce the assessment.

Tasks were pilot tested with 40 sixth graders (Anglo and Hispanic) two types of instructional settings: hands-on and traditional. Results showed: raters using this type of rating scheme can be trained to be very consistent in their scoring; the assessments are costly and time-consuming; a considerable number of tasks need to be administered to provide a reliable estimate of a student's level of achievement; student performances on the hands-on tasks differed by the type of instructional setting (evidence of validity); and there was differential scoring on the part of Hispanics, leading to some equity concerns.

(AL#500.6MATPEA)

Beaton, Albert E., Ina V. S. Mullis, Michael O. Martin, et al. *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)*, November 1996. Available from: TIMSS International Study Center, Center for the Study of Testing, Evaluation, and Educational Policy, Campion Hall, School of Education, Boston College, Chestnut Hill, MA 02167, (617) 552-4521. Internet: http//wwwcsteep.bc.edu/timss

The Third International Mathematics and Science Study tested fifth grade levels in 45 countries speaking more than 30 different languges. Questions covered fractions and number sense, measurement, proportionality, data manipulation, geometry and algebra. One-fourth of the questions (one-third of the testing time) were free response. To help interpret results, TIMMS collected extensive information about instruction and other contextual factors. The report summarizes results and provides a few of the test questions (multiple choice as well as short answer). Some interesting results included:

1. Although some countries did better than others, students everywhere had difficulties with multi-step problems and porportionality.

2. In every country, achievement was related to attitude toward math (higher liking, higher scores).

3. Almost all students felt they did well in math, a perception that didn't always match to reality.

4. Internationally, the most frequently cited reason for needing to do well in math was to get into a good high school or university.

5. The relationship between achievement and instructional factors was not clear.

6. There was a clear relationship between achievement and home factors.

(AL#500.6MATACM)

Bellanca, James, Carolyn Chapman, and Elizabeth Swartz. *Multiple Assessments for Multiple Intelligences*, 1994. Available from: IRI/Skylight Training and Publishing, Inc., 200 E. Wood St., Suite 274, Palatine, IL 60067, (800) 348-4474, (847) 991-6300, fax: (847) 991-6420, e-mail: irisky@xnet.com

The authors have created a logical and usable guide for assessment in the classroom based on the premise that the seven intelligences should form the basis for curriculum, instruction, and assessment. The authors first introduce "strategies" for assessment such as journals, exhibits, and performances; and "tools" for assessment such as rubrics, checklists, and quizzes. Then there is a chapter devoted to each intelligence that covers: (a) the definition of the intelligence, (b) why the intelligence is important in the curriculum, (c) examples of

instructional processes that develop the intelligence, (d) sample rubrics, and (e) sample strategies.

There is a nice section on portfolios that describes four standards for a good portfolio: organized, selective, representative, and insightful. I like many of the ideas in this book. The rubric examples are a little too sketchy for my taste, and it seems that the book would be best used by teachers who already have a basic understanding of the seven intelligencies. No technical information is included.

(AL#000.6MULASM)

British Columbia Ministry of Education. *Performance Assessment: Primary, Early, Late, Intermediate, and Graduate, and Hypercard Tour.* Draft, August 1992. Available from: Ministry of Education, Assessment Branch, 617 Government St., Victoria, British Columbia V8V 2M4.

This is a Macintosh disk containing a host of performance assessments developed by the British Columbia Ministry of Education for all grade levels and subject matter areas.

(AL#000.3BCPERA)

Burns, Marilyn. *Math and Literature (K-3)*, 1992. Available from: Math Solutions Publications, Marilyn Burns Education Associates, 150 Gate 5 Rd., Suite 101, Sausalito, CA 94965, (415) 332-4181, fax (415) 331-1931.

The author's premise is that "children's books are effective classroom vehicles for motivating students to think and reason mathematically." The book describes instructional ideas for linking math and literature in grades K-3. Samples of student work are included. The book is included on this bibliography because it might provide ideas for tasks that would be useful in performance assessments.

(AL#500.5MATLIT)

Burton, Grace, Terrence Coburn, John Del Grande, et al. *Addenda Series, Grades K-6: Curriculum and Evaluation Standards for School Mathematics*, 1991-92. Available from: National Council of Teachers of Mathematics, 1906 Association Dr., Reston, VA 22090, (800) 235-7566.

Addenda is a series of booklets to support the NCTM Standards. This series provides instructional ideas for grades K-6 for the areas of patterns, geometry/spatial sense, making sense of data, and number sense/operations. The reference is included here because the exercises might suggest tasks that could be used in performance assessments.

(AL#500.5ADDSEK)

Burton, Leone. ***Assessment of Mathematics—What Is the Agenda?*** **Located in: Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge, Menucha Birenbaum and Filip J. R. C. Dochy, Eds., 1996, pp. 31-61. Available from: Kluwer Academic Publishers, 101 Philip Dr., Assinippi Park, Norwell, MA 02061**

This is an excellent article, although written in a very academic and dense style. The author:

- First, compares a "traditional" approach to teaching math with a more constructivist approach
- Second, describes the efforts of four countries to implement change in math assessment and instruction
- Third, provides considerable rationale for the switch in approach.

Sample assessment items from the four countries discussed are included.

(AL#500.6ASSMAW)

California Assessment Collaborative. ***Charting the Course Toward Instructionally Sound Assessment—A Report of the Alternative Assessment Pilot Project*****, September 1993. Available from: California Assessment Collaborative, 730 Harrison St., San Francisco, CA 94107, (415) 241-2704.**

The California Assessment Collaborative was designed as a three-year effort to systematically identify, validate, and disseminate alternatives to standardized testing throughout the state. This report presents findings from 22 projects during the first year, including costs, impacts, and recommendations about future work. The book does an excellent job of placing assessment change into the context of restructuring. It discusses how the following fit together: articulating content standards, monitoring student progress toward goals, building teacher capacity to assess, building student capacity to self-assess, student outcomes, curriculum, and instruction.

(AL#150.6CHACOU)

California Department of Education. ***Students, Standards and Success—The California Learning Assessment System—Communications Assistance Packet*****, 1993. Available from: California Department of Education, Publications Sales, PO Box 271, Sacramento, CA 95812, (916) 657-3747 or (800) 995-4099.**

The purpose of this document is to introduce the *California Learning Assessment System* (CLAS) to the public. It gives an overview of the system and helps with setting up communication efforts. Although the CLAS system is no longer in place, others might get ideas from this document on things such as letters to parents, answers to frequently asked

questions, sample press releases, sample meeting agendas, information on the assessments, resources, and sample items and student responses.

(AL#000.6STUSTS)

California Learning Assessment System (CLAS). *A Sampler of Mathematics Assessment—1994*. Available from: Publications Sales, California Department of Education, PO Box 271, Sacramento, CA 95802.

The 1993 and 1994 CLAS math assessment used three formats: multiple choice, short answer, and open ended. The open-ended problems were scored using a four-point holistic rubric emphasizing conceptual understanding and quality of communication. Results from performance on all three types of formats were used to determine an overall "performance level" for each student. There were six possible levels. The highest level (6) describes overall work that demonstrates rigorous mathematical thinking, consistent completeness and correctness, and logical arguments.

The majority of the book consists of 1993 and 1994 samples of open-ended student work scored using the 4-point holistic rubric. In each of grades 4, 8, and 10 the authors present at least one sample problem and eight different student responses. (Seven problems and 64 student responses are shown in all. One 4th grade problem and 8 responses are in Spanish.)

The book also includes sample multiple choice and short answer questions. No technical information is included. Note: The CLAS system is no longer used in California; however, there are many good ideas in this publication.

(AL#500.3SAMMAS4)

California Mathematics Council. *Constructive Assessment in Mathematics*, Vol. 87, December 1994. Available from: California Math Council, 1414 S. Wallis, Santa Maria, CA 93454, (805) 925-0774.

I rather liked this one, although sometimes topics were dealt with in too sketchy a manner and the link between concepts was not always clear. It has nice discussions of rubrics, the change process, and trends in math instruction and assessment. A definite plus is the inclusion of professional development activities for teachers, including assisting teachers to think through their assumptions and beliefs; and kick-off activities for assessment training. I think this would best be used by knowledgeable trainers looking for professional development ideas.

(AL#150.6CONASM)

Campbell, Linda, Bruce Campbell, and Dee Dickinson. ***Teaching and Learning Through Multiple Intelligences*****, 1996. Available from: Allyn & Bacon, 111 Tenth St., Des Moines, IA 50309, (515) 284-6751, (800) 278-3525.**

This book describes Howard Gardner's "seven intelligences," provides checklists for identifying students' dominant intelligences and working styles, how to set-up a learning environment that stresses each intelligence, instructing students through their strengths, instructional activities that foster the development of various intelligences, designing assessments that allow different ways for students to demonstrate their achievement, and portfolios. The section on assessment stresses the design of performance tasks to accommodate different intelligences. No performance criteria or technical information is provided. Some samples of student work are included.

(AL#000.6TEAALE)

Carpenter, Thomas P., James Hiebert, Elizabeth Fennema, et al. ***A Framework for the Analysis of Teaching and Learning Understanding of Multidigit Numbers.*** **Information on date and availability is unknown.**

This paper presents a way to analyze instruction in math to see whether it is designed to foster understanding, defined as making relevant connections between knowledge. The specific example in the paper relates to multidigit numbers. Dimensions of instruction thought to be critical in promoting understanding include: the scope and sequence of concepts, connections among representations as a basis for establishing meaning for symbols, the nature of problem solving, degree of teacher specification of solution procedures and connections, students' articulation of solution procedures, and coherence between and within lessons.

Most of the paper describes each of these dimensions in detail. Several pages at the end discuss in general terms the kinds of tasks one could give to students to see whether they are making the appropriate connections.

(AL#500.4FRAANT)

Center for Talent Development. ***Elementary School Pre-Post Survey*** **and** ***Middle/High School Pre-Post Survey,*** **1992. Available from: Evaluation Coordinator, Center for Talent Development, Northwestern University, Andersen Hall, 2003 Sheridan Rd., Evanston, IL 60208, (708) 491-4979.**

This document contains surveys of student attitudes toward mathematics and science. There are two levels—elementary and middle/high school. It was designed for use with Access 2000 participants who are primarily African-American and Hispanic students in an inner-city

public school system and enrolled in a math/science/engineering enrichment program. No technical information is included.

(AL#220.3QUEELM)

Central Kitsap School District. *The Student Friendly Guide to Mathematics Problem Solving*, April 1997. Available from: Central Kitsap School District, Curriculum Department, PO Box 8, Silverdale, WA 98383, (360) 692-3101.

Staff at Central Kitsap School District in Washington state have worked for three years to develop and refine rubrics for open-ended math problems. The rubric contains three traits—mathematical knowledge concepts and procedures, problem solving, and communication. This document contains both the "student-friendly" version and the adult version.

(AL#500.3STUFRG)

Champagne, Audrey B. *Cognitive Research on Thinking in Academic Science and Mathematics: Implications for Practice and Policy*. Located in: Enhancing Thinking Skills in the Sciences and Mathematics, Diane Halpern (Ed.), 1992. Available from: Lawrence Erlbaum Associates, Publisher, 365 Broadway, Hillsdale, NJ 07642, (800) 926-6579.

Although this article is not strictly about assessment, it discusses some topics of relevance to assessment. Specifically, it has a very nice section on the relationship between the tasks given to students and what they learn. For example, students have more trouble integrating knowledge if they are never given tasks that require them to do this. Likewise, one can't assess a skill such as integrating knowledge if the assessment task doesn't require students to do it.

(AL#000.6COGRET)

Charles, Randall, Frank Lester, and Phares O'Daffer. *How to Evaluate Progress in Problem Solving*, 1987. Available from: National Council of Teachers of Mathematics, 1906 Association Dr., Reston, VA 22091.

This monograph attempts to assist educators with the challenge of developing new techniques for evaluating the effectiveness of instruction in problem solving by clarifying the goals of problem-solving instruction, and illustrating how various evaluation techniques can be used in practice. Goals include: select and use problem-solving strategies, develop helpful attitudes and beliefs, use related knowledge, monitor and evaluate thinking while solving problems, solve problems in cooperative learning situations, and find correct answers.

Evaluation strategies include: informal observation/questioning and recording results using anecdotal records or a checklist (two are provided); interviews (a sample interview plan is

provided); student written or oral self-report of what's happening during a problem-solving experience (a list of stimulus questions is given, as is a checklist of strategies); attitude inventories (two are given); rating scales (three-trait analytic and focused holistic scales are given); and multiple-choice and completion (sample items are given to assess various problem-solving abilities). No technical information nor student sample performances are provided.

(AL#500.6HOWTOE)

Clarke, David. *Constructive Assessment in Mathematics—Practical Steps for Classroom Teachers*, 1997. Available from: Key Curriculum Press, PO Box 2304, Berkeley, CA 94702, Internet: http://www.keypress.com

This little 75-page book is a must-read! It has so many good ideas packed into a small space that it's impossible to list them all here. For example, the author discusses the need to (and gives assessment ideas for) modeling good mathematical and instructional practices, provides many assessment samples that tap various types of mathematical thinking, how to make assessment instruction, and how to think about grading.

(AL#500.6CONASM)

Clark, David. *The Mathematics Curriculum and Teaching Program*, 1988. Available from: Curriculum Development Centre, PO Box 34, Woden, ACT 2606, Australia. Also available from: ERIC ED 287 722.

This document was developed to assist classroom teachers in grades 1-6 to improve their day-to-day assessment of mathematics. Content includes: rationale for assessment alternatives in mathematics, instructions for a two-day inservice program using the materials, instructions on how classroom teachers can use the materials without training, and a series of exercises, formats and ideas for classroom assessment. Assessment ideas include: help with systematically recording information from informal observations using checklists and "folios" of student work, setting-up opportunities for assessment by giving students good tasks to do, assessing problem solving, student self-reflection, and communicating results.

This is written in a very user-friendly manner and contains some good ideas, especially in the areas of designing tasks, problem solving and self-reflection. We found some of the descriptions of activities a little too sketchy.

(AL#500.3MCTPMA)

Clarke, David, and Max Stephens. ***The Ripple Effect: The Instructional Impact of the Systemic Introduction of Performance Assessment in Mathematics.*** **Located in: Menucha Birenbaum and Filip J. R. C. Dochy, Eds., Alternatives in Assessment of Achievements, Learning Processes and Prior Knowledge, 1996, pp. 63-92. Available from: Kluwer Academic Publishers, 101 Philip Dr., Assinippi Park, Norwell, MA 02061.**

This study examined the extent to which changes in assessment (in Victoria, Australia) triggered changes in instructional practices in high school (years 7-12). In 11 high schools, the authors:

- Examined documents relating to curriculum, instruction, and assessment
- Conducted surveys
- Did indepth interviews with, and observation of, teachers.

Results were:

- There was lots of evidence in the documents of adoption of the distinctive elements of the Victoria assessment scheme
- Surveys and interviews confirmed the document review—teachers reported changes in practice
- Changes in practice included more investigative projects, problem solving, use of math in real-life contexts, and report writing
- Other changes in practice consistent with changes in theory about math teaching and learning (such as portfolios and student self-assessment) but not used in the Victoria system, showed little increase in use
- The principle motivation leading to change was the pragmatic one of preparing students for the demands of a more rigorous test

Survey instruments are not included; however, some could be reconstructed from the data tables.

(AL#500.4RIPEFI)

Clarridge, Pamela Brown and Elizabeth M. Whitaker. ***Implementing a New Elementary Progress Report.*** **Located in: Educational Leadership 52, October 1994, pp. 7-9. Also available from: Tucson Unified School District #1, 1010 E. Tenth St., Tucson, AZ 85719.**

This paper reports on one district's attempt to revise its report card for grades K-5. Staff decided on a rubric approach. In grades 1-5, rubrics using four-point scales were developed for five "learner qualities"—self-directed learner, collaborative worker, problem solver, responsible citizen, and quality producer, and eight content areas—reading, writing, listening/speaking, mathematics, social studies, science, health, and fine arts. Room is provided on the report card for teacher comments, the basis for the judgment about student ability (e.g., classroom observation, portfolios), and teacher/student comments.

The authors describe development and pilot testing, preliminary responses from parents and students, plans for revision, and insights (such as "this approach to reporting requires a thorough understanding of the curriculum by both parents and teachers").

(AL#150.6IMPNEE)

Collis, Kevin F. and Thomas A. Romberg. ***Collis-Romberg Mathematical Problem Solving Profiles*****, 1992. Available from: Australian Council for Educational Research Limited, 4(ACER), Private Bag 55, Camberwell Victoria 3124, Australia, (03) 277-5555, fax: (03) 277-5500. Also available from: ASHE, PO Box 31576, Richmond, VA 23294, (804) 741-8991.**

This assessment device for students in grades 2-5 has 20 open-ended problems to solve—one problem in each of five areas (algebra, chance, measurement, number, and space) with four questions per problem area designed to tap developmental level of formal reasoning. For example, the "A" question determines whether the student can use one obvious piece of information from the item, while the "D" question determines whether the student can use an abstract general principle or hypothesis derived from the information in the problem. Responses to each question are scored right/wrong. The number of correct responses determines a developmental level. Suggestions are given for instructional strategies for the various developmental levels. Technical information in the manual includes typical performance for various grade levels, teacher judgment on the developmental level indicated by each task, and additional analyses to show validity of the inferences drawn.

(AL#500.3COLROM)

Colorado Department of Education. ***Standards & Assessment Resource Bank, Version 2.0,*** **July 1997. Available from: Colorado Department of Education, 201 E. Colfax Ave., Denver, CO 80203, (303) 866-6915, fax: (303) 830-0793. Internet: Resource_Bank@cde.state.co.us**

This CD-ROM includes more than 40 teacher-developed classroom units and assessments aligned to the Colorado State Model Content Standards, "updated information about the Colorado Student Assessment Program, student art work from the Cherry Creek Arts Festival, standards developed by Cherry Creek and Summit County school districts, information about Douglas County's district assessments, and many more quality items designed to support your implementation of standards-based education."

(AL#000.1STAASR)

Commission on Standards for School Mathematics. ***Curriculum and Evaluation Standards for School Mathematics*****, 1989. Available from: National Council of Teachers of Mathematics, 1906 Association Dr., Reston, VA 22091.**

This book contains standards for curriculum and assessment that attempt to create a coherent vision of what it means to be mathematically literate. This book has been quoted extensively and is the current "standard" for what should be in a math curriculum.

The assessment section covers: three statements of philosophy concerning assessment (alignment, multiple sources of information, and appropriate assessment methods and uses); seven sections on assessing various student outcomes (e.g., problem solving, communication, reasoning, concepts, procedures, and dispositions); and four sections on program evaluation (indicators, resources, instruction, and evaluation team). Each of the seven sections on assessing student outcomes briefly describes what the assessment should cover and provides some sample assessment tasks and procedures.

(AL#500.5CURANE)

Conley, David T. ***Proficiency-Based Admission Standards*****, January 8, 1995. Available from: PASS Project, Oregon State System of Higher Education, Office of Academic Affairs, PO Box 3175, Eugene, OR 97403, (503) 346-5799.**

This paper describes the Oregon Board of Higher Education's new policy on admitting students by demonstration of competencies rather than number of courses taken or GPA. Included is the rationale for the approach (including the incongruity between traditional college admissions procedures and the attempt by K-12 schools to restructure), a list of the competencies, ideas for assessment, ideas for how high schools might need to change in order to ensure students meet admissions standards, and commonly asked questions. Competencies include subject area content (science, math, etc.) as well as basic and process skills (writing, reading, critical thinking, etc.).

The paper addresses the concern by some parents and teachers that changes in K-12 education won't mean anything if students are still admitted to college using traditional methods. The authors point out that similar changes in college admissions policy are occurring nationwide.

(AL#150.6PROBAA)

Crowley, Mary L. *Student Mathematics Portfolio: More Than a Display Case.* Located in: The Mathematics Teacher 86, October 1993, pp. 544-547.

The author discusses the use of mathematics portfolios to document progress on the "big" NCTM outcomes—problem solving, valuing mathematics, developing mathematical confidence, communicating mathematically, and reasoning mathematically. She includes a fair amount of detail on a middle school example—sample letter to students outlining the task, a description of what students need to include and a hint of how content might be assessed. The portfolio is semi-structured—the teacher specifies categories of entries and the student selects which samples of work to include in each category. Students must also write explanations for their selections. A few samples of student work are included. Detailed performance criteria are not included.

(AL#500.3STUMAP)

Csongor, Julianna E. *Mirror, Mirror On The Wall...Teaching Self-Assessment to Students.* Located in: The Mathematics Teacher 85, November 1992, pp. 636-637. Also available from: Saint Maria Gosetti High School, 10th and Moore, Philadelphia, PA 19148.

The author presents a procedure for getting high school students to self-reflect in math: during the final five minutes of a test, students estimate how sure they are about each answer they gave on the test (100%, 75%, 50%, or 0%). They can earn extra credit on the test if their estimates fall within 3% of their actual score. She reports that students are surprisingly accurate in their estimates and that the procedure works especially well with slow learners.

(AL#500.3MIRMIW)

CTB McGraw-Hill. *CAT/5 Performance Assessment Component, 1993.* Available from: CTB/McGraw-Hill, 2500 Garden Rd., Monterey, CA 93942, (800) 538-9547, fax (800) 282-0266.

The "CTB Performance Assessments" are designed to either be stand-alone or integrated with the CAT/5 or CTBS/4. There are five levels for grades 2-11. The total battery includes reading/language arts, mathematics, science, and social studies and takes 2-3 hours to administer. There are 12-25 short- to medium-response questions for each subtest. The math and science subtests take 30-40 minutes. (For the CAT/5 there is a checklist of skills that can be used at grades K and 1.)

Some questions are grouped around a common theme. They require short answers. For example, questions on one level include: "What are two ways that recycling paper products helps the environment?" "This table shows the air temperatures recorded every two hours from noon to midnight...At what time did the temperature shown on the thermometer most likely occur?" and "These pictures show some of the instruments that are used in science...List two physical properties of the water in the jar below that can be measured with the instruments shown in the pictures. Next to each property, write the name of the instrument or instruments used to measure the property."

Some of the answers are scored right/wrong and some are scored holistically. The materials we received contained no examples of the holistic scoring so we are unable to describe it. Scoring can be done either locally or by the publisher. When the *Performance Assessments* are given with the CAT/5 or CTBS/4, results can be integrated to provide normative information and scores in six areas. Only three of these, however, use information from the math and science subtests: demonstrating content and concept knowledge, demonstrating knowledge of processes/skills/procedures, and using applications/problem-solving strategies. When the *Performance Assessments* are given by themselves, only skill scores are available.

The materials we received contain sample administration and test booklets only. No technical information or scoring guides are included.

(AL#060.3CAT-5a)

CTB McGraw-Hill. *[CTB Item Bank] Performance Assessment Task Bank—Sample Tasks, Mathematics, Grade 3, Grade 6, Grade 8,* and *Grade 9*, circa 1997. Available from: CTB/McGraw-Hill, PO Box 150, Monterey, CA 93942, (800) 538-9547, fax (800) 282-0266.

The CTB math task bank contains several hundred short-answer math tasks for grades 3, 6, 8, and 9, plus algebra. (There is also a language arts bank.) Each series of questions is comprised of one or more theme-based activities. For example, the ninth grade bank contains a series of questions that relate to "selling advertisements for the yearbook." Questions require students to do such things as: identify how many ads of various sizes can fit on a single page; how much money different types of layouts can generate; and how many ads need to be sold to cover expenses. Most tasks are, thus, very structured and have only one right answer. However, some are more open-ended. For example, part of a grade 6 task is: "List three things you must consider to help you estimate whether the newspaper can be published without costing the school any money." Additionally, several tasks attempt to get at self-reflection: "Draw a circle around the number below that shows how easy or how hard it was for you to solve the problems in this task." Tasks can be assessed by student learning goal (tasks are cross-referenced to the NCTM standards), theme (e.g., yearbook ads), or question difficulty.

The publisher reports that "each of the activities associated with a task has a set of scoring directions. These contain scales for scoring each activity and contain meaningful labels for

each of the scale values. Judgments or problem solving, reasoning, communication, etc. are made by scores for procedures." We have not actually seen the scoring materials so we cannot tell whether the publisher is describing task-specific or generalized scoring.

The publisher reports that "each of the tasks...has been field tested to determine its validity in assessing stated learner outcomes, enabling teachers to have complete confidence in assessments they use in the classroom." We have not personally seen the technical information. CTB also publishes software to support the task bank. This includes test generation and scoring.

(AL#500.2CTBPEA)

Cullen, Carol, and Pat Barron. ***Authentic Assessment Strategies for Elementary Science and Mathematics: A Beginning*****, 1994. Available from: ERIC Document Reproduction Service, Dyncorp I&ET, 7420 Fullerton Rd., Suite 110, Springfield, VA 22153, (800) 443-3742, fax: (703) 440-1408, Internet: edrs@inet.ed.gov ERIC ED#389 525.**

The authors present 11 assessment tasks for grades 1-5 built to meet the assessment quality standards of:

- Relate directly to instructional goals identified as desired student outcomes
- Require students to apply what they had learned
- Have more than one correct answer or possible outcome
- Involve more than one step to complete

Each task includes:

- Summary of the activity
- Learning outcomes
- Assessment information
- Scoring
- Issues and implications
- Impact
- References

Assessments are of varying degrees of quality and are, therefore, best for knowledgeable users looking for ideas. Assessment quality problems include such things as lists of outcomes to be assessed that don't match to the criteria and skimpy criteria.

Both task-specific and general rubrics are represented. Tasks were piloted but presented by the authors as "works in progress."

(AL#500.3ATTASS)

Curriculum Corporation. ***Mathematics—A Curriculum Profile for Australian Schools, Mathematics—Work Samples,*** **and** ***Using the Mathematics Profile,*** **1994. Available from: Curriculum Corporation, St. Nicholas Pl., 141 Rathdowne St., Carlton, Victoria, 3053, Australia, (03) 639-0699, fax (03) 639-1616.**

These documents represent the mathematics portion of a series of publications designed to reconfigure instruction and assessment in Australian schools. The project, begun in 1989, was a joint effort by the States, Territories, and the Commonwealth of Australia, initiated by the Australian Education Council.

The profiles are not performance assessments, per se, in which students are given predeveloped tasks. Rather, the emphasis has been on conceptualizing major student outcomes in each area and articulating student development toward these goals using a series of developmental continuums. These continuums are then used to track progress and are overlaid on whatever tasks and work individual teachers give to students.

The math profiles cover the major strands of: working mathematically, space, number, measurement, chance/data, and algebra. Each strand has sub-areas called "organizers." For example, the strand of "working mathematically" contains the organizers of: investigating, conjecturing, using problem-solving strategies, applying and verifying, using mathematical language, and working in context. Each organizer is tracked through eight levels of development. For example, the organizer of "using mathematical language" has "talks about mathematical ideas in natural language" at Level 1, and "makes fluent use of mathematical notation in solving problems and presenting arguments succinctly, coherently and in conventional forms" at Level 8.

There are lots of support materials that describe what each strand means, how to organize instruction, types of activities to use with students, and how to use the profiles to track progress. Samples of student work are included to illustrate development. The documents say that the levels have been "validated," but this information is not included in the materials we received.

(AL#500.3MATCUP)

Doig, Brian. ***Activities and Assessment in Mathematics (AAIM),*** **1995. Available from: The Australian Council for Educational Research Ltd., 19 Prospect Hill Rd., Camberwell, Melbourne, Victoria 3124, Australia, 03-819-1400.**

The AAIM is a collection of over 200 math tasks which cover the five strands of the Australian *Curriculum Profile*—number, space, measurement, chance/data, and problem solving. It is designed for students in upper elementary and lower secondary (grades 4-9). The author suggests two primary uses—diagnosis of student skills in specific content areas, and tracking student development along the curriculum strands. All scoring is task specific. Since tasks are keyed to the stages of the curriculum profile, getting a high score on a task is, presumably, an indicator of student acquisition of skill at the level to which the task relates.

The document includes a user's manual and all 200 tasks and associated scoring guides. No sample student work nor technical information is included.

(AL#500.3ACTASM)

Educational Testing Service. ***Miscellaneous alternative assessments*****, 1993. Available from: Educational Testing Service, 1979 Lakeside Pkwy, Suite 400, Tucker, GA 30084, (404) 723-7424.**

Six teams of elementary and middle schools in Georgia, in conjunction with the ETS Southern Field Office in Atlanta, are working on math and science assessment activities (cooperative group, videotape, open-ended experiments) that can be used across grades and content areas, and that are designed to assess science process skills, math problem solving, ability to communication in science and math, and content knowledge.

The materials we have include scoring guides (both general and task-specific, and holistic and analytical trait) and scored samples of student work. No technical nor contextual information is included in the materials (although such information is available from the publisher).

Any use requires permission from Educational Testing Service.

(AL#000.3MISALA)

Educational Testing Service. ***NAEP 1992 Mathematics Report Card for the Nation and the States*****, April 1993, Report No. 23-ST02. Available from: Education Information Branch, Office of Educational Research and Improvement, US Department of Education, 555 New Jersey Ave NW, Washington, DC 20208, (800) 424-1616 or (202) 219-1651.**

The National Assessment of Educational Progress (NAEP) is congressionally mandated. Tests are given in reading, writing, math, science, social studies, fine arts, writing, literature, career development, and computers to students in grades 4, 8, and 12 on a revolving basis—not all subject areas are given each year. This entry describes the 1992 math assessment which tested approximately 220,000 students from 9,000 schools.

The 1992 on-demand tests covered numbers/operations, measurement, geometry, data analysis/statistics/probability, algebra/functions, and estimation. These content areas were covered at three levels: conceptual understanding, procedural knowledge, and problem solving. There were both multiple-choice and short answer (e.g., measure an angle and write in the measurement) questions. Some of the questions required short explanations. For example, one fourth grade question asked students to choose the graph that represented the number of pockets in the clothing worn by a class of 20 students and provide an explanation of why they picked the graph they did. Responses were scored right/wrong.

The 1992 math assessment marks a shift to reporting by proficiency levels. For example, the "Basic" level designates conceptual and procedural understanding, while the "Advanced" level represents the ability to generalize and synthesize concepts and principles. The report contains NAEP background information on the achievement levels and how they were set, sample items illustrating the levels, and lots of tables of results by states, regions, and various demographics such as gender and ethnicity. Released sets of items are available in other documents.

(AL#500.6NAEPMAR)

EQUALS. *Assessment Alternatives in Mathematics*, 1989. Available from: University of California, Lawrence Hall of Science, Berkeley, CA 94720, (415) 642-1823.

This document provides an overview of some possible assessment methods in mathematics that cover both process and products. Specific examples are given for writing in mathematics, mathematical investigations, open-ended questions, performance assessment, observations, interviews, and student self-assessment. Any of the student-generated material could be self-selected for a portfolio of work. The document also includes a discussion of assessment issues and a list of probing questions teachers can use during instruction.

(AL#500.6ASSALI)

EXEMPLARS. *EXEMPLARS—A Teacher's Solution*, undated. Available from: EXEMPLARS, RR 1, Box 7390, Underhill, VT 05489, (800) 450-4050, fax: (802) 899-4409. Internet: EXEMPLARS@AOL.COM

EXEMPLARS is a bank of constructed response math tasks for grades K-8. All of the problems are multi-steps and many have more than one correct answer. Problems are presented orally and in writing; many use manipulatives; all require a paper and pencil response. A general, three-trait rubric is provided (understanding, strategies, and communication) that has four score points (novice, apprentice, practitioner, and expert). However, the scored samples of work that come with each problem appear to be scored holistically. All problems are teacher developed and piloted. No technical information is included. I rather liked this one, although I might quibble over the fact that they regularly say that some NCTM goals are "assessed" (e.g., connections, even though "connections" is not part of the scoring guide; the authors respond that to get a high score, students must demonstrate connnections). The general rubric is a little skimpy in detail. The latest samples in the collection we have are 1996.

(AL#500.3EXETES)

Far West Laboratory for Educational Research and Development. ***Focus on Educational Resources, Spring 1995; Knowledge Brief, Number 12, 1995; Knowledge Brief, Number 11, 1993.*** **Available from: Far West Laboratory, 730 Harrison St., San Francisco, CA 94107, (415) 565-3000.**

This set of documents from 1993 to 1995 discusses the following topics:

- The ways in which assessments can mask the achievement of culturally diverse students instead of highlighting them
- The hopes and fears associated with the use of alternative assessments and culturally diverse students
- Examples of assessment tasks and their language demands which place extra constraints on ESL students
- Examples of how community members in Chinle, Arizona, modified assessment tasks to be more culturally relevant

(AL#150.6ISSCRA)

Ferguson, Shelly. ***Zeroing in on Math Abilities*****, 1992. Located in: Learning92, Vol. 21, pp. 38-41.**

This paper was written by a fourth grade teacher and describes her use of portfolios in math—what she has students put in their portfolios, the role of self-reflection, getting parents involved, and grading. She gives a lot of practical help. One interesting idea in the paper has to do with grading. At the end of the grading period she reviews the portfolios for attainment of concepts taught (not amount of work done), and progress toward six goals set by the NCTM standards (e.g., thinks mathematically, communicates mathematically, and uses tools). She marks which goals were illustrated by the various pieces of work in the portfolio and writes a narrative to the student. Another interesting idea is formal presentations of their portfolios by students to their parents. The article provides a sample comment form for parents and students to complete.

(AL#500.3ZERMAA)

Finston, D., A. Knoebel, and D. Kurtz. ***Student Assessment Using Student Research Projects,*** **1993. Available from: Douglas S. Kurtz, Professor of Mathematics, Department of Mathematical Sciences, New Mexico State University, Box 30001, Las Cruces, NM 88003, (505) 646-6218.**

This program (used in grades 9-university) is based on "student research projects," multi-step assignments lasting up to several weeks, which focus on problem-solving skills and writing. Students work in groups of 3-4. Sample projects in the document include remodeling a

house, deciphering averages, determining tunnel clearances, and designing revolutionary solids. Assessment of student work is based on teacher evaluation of written reports. The sample scoring guides included in the document generally include content, process, and communication skills, but are fairly sketchy. No technical information is included.

(AL#500.3STUASU)

Fitzpatrick, Robert and Edward J. Morrison. *Performance and Product Evaluation*. Located in: Educational Performance Assessment, Fredrick L. Finch (Ed.), 1991. Available from: The Riverside Publishing Company, 8420 Bryn Mawr Ave., Chicago, IL 60631, (800) 323-9540.

This paper has interesting discussions of the following topics:

1. What "authenticity" in tasks means. The authors' position is that there are many degrees and kinds of artificialities in tests. "Performance and product evaluation are those in which some criterion situation is simulated to a much greater degree than is represented by the usual paper-and-pencil test.... [However,] there is no absolute distinction between performance tests and other classes of tests—the performance test is one that is *relatively* realistic."

2. Criteria for deciding how much "reality" to include in tasks.

3. Descriptions of various types of tasks that can be used in performance assessments: in-basket, games, role-plays, projects, etc.

4. Steps for developing performance assessments: analysis of the important dimensions of the skills to be covered, identification of tasks that cover as many of the important skills as possible, developing instructions and materials, and developing the scoring procedure.

Most specific examples are taken from military and business applications.

(AL#150.6PERPRE)

Fort Hays Educational Development Center, The. *State Assessment—Math*, March 15, 1995. Available from: Steve Nolte, The Fort Hays Educational Development Center, 305 Picken Hall, Hays, KS 67601, (913) 628-4382, fax (913) 628-4084.

Beginning with the 1995 administration, the Kansas math assessment covers problem solving, reasoning, and communication skills in grades 4, 7, and 10. Multiple choice, multiple mark, and open-ended items are used.

The open-ended problems include many content areas and skills and involve no manipulatives. Open-ended problems are scored for math communication, reasoning, and

problem solving using six-point (0-5), generalized rubrics. Problem solving is further broken down into four dimensions—understanding the problem, choosing a problem solving strategy, implementing the strategy, and finding/reporting a conclusion. The rubrics include a lot of detail; it is one of my favorites. This document includes rubrics, scoring forms, and 30 pages of student work in grades 4, 7, and 10. No technical information is included.

(AL#500.3STAASM)

Fraser, Barry J., John A. Malone, and Jillian M. Neale. *Assessing and Improving the Psychosocial Environment of Mathematics Classrooms.* Located in: Journal for Research in Mathematics Education 20, 1989, pp. 191-201.

This article describes the development of a short form of the *My Class Inventory* to be used in sixth grade math classes to measure the "psychosocial" characteristics of the classroom learning environment, e.g., social interactions.

(AL#500.3ASSIMP)

Glaser, Robert. *Expert Knowledge and Processes of Thinking.* Located in: Enhancing Thinking Skills in the Sciences and Mathematics, Diane Halpern (Ed.), 1992. Available from: Lawrence Erlbaum Associates, Publisher, 365 Broadway, Hillsdale, NJ 07642, (800) 926-6579.

In this article the author describes current research on expert performance. Although not directly about assessment, the notion of "expertise" can be used to develop criteria for evaluating performance tasks. For example: experts perceive large, meaningful patterns, have skillful self-regulatory processes, etc.

A critical point made by the author is that, "Practice, as it comes about in the usual course of training, is not necessarily very efficient. On the basis of our knowledge of the specific aspects of competence and expertise, we are able to find ways to compress or shortcut experience.... This is one goal for performance assessment, we help students understand current conceptions of the relevant dimensions of a task so that they don't have to rediscover this themselves."

(AL#050.6EXPKNP)

Greenwood, Jonathan Jay. *On the Nature of Teaching and Assessing "Mathematical Power" and "Mathematical Thinking."* Located in: Arithmetic Teacher, November 1993, pp. 144-152.

This is a useful paper for assisting teachers in defining the characteristics of sound mathematical thinking.

The authors discuss the meaning of the NCTM goals of "mathematical power" and "mathematical thinking," seven characteristics of sound mathematical thinking, and general rating scales for each characteristic.

The seven characteristics are: (1) Everything you do in mathematics should make sense to you. (2) Whenever you get stuck, you should be able to use what you know to get yourself unstuck. (3) You should be able to identify errors in answers, in the use of materials, and in thinking. (4) Whenever you do a computation, you should use a minimum of counting. (5) You should be able to perform calculations with a minimum of rote pencil-paper computations. (6) When the strategy you are using isn't working, you should be willing to try another strategy instead of giving up. (7) You should be able to extend, or change, a problem situation by posing additional conditions or questions. No technical information is included. Sample instructional tasks and student performances are included.

(AL#500.6ONNATT)

Guide to the Maine Educational Assessment—1992-1993. **Available from: Sally Rindfleisch, MEA Project Director, 171 Watson Rd., PO Box 1217, Dover, NH 03821, (603) 749-9102, fax (603) 749-6398. For information, contact Timothy J. Crockett, Coordinator, Maine Educational Assessment, Department of Education, State House Station #23, Augusta, ME 04333, (207) 287-5991.**

The Maine Educational Assessment (MEA) has been in place since 1984. It assesses reading, writing, mathematics, science, social studies, health, and arts/humanities at grades 4, 8, and 11. Not all subjects are assessed in any given year. Students answer multiple-choice as well as more open-ended questions. On the science and math tests, all open-ended questions are paper-and-pencil based (no hands-on activities) and all responses are in writing.

The math test covers procedural knowledge, conceptual knowledge, and problem solving in the various content strands of the NCTM curriculum standards. some responses call for lengthier explanations than others. All work is scored using a holistic, 5-point (0-4) scale that emphasizes: (a) the correct solution, (b) an appropriate strategy, and (c) solution is shown with a correct label or description if necessary. This generalized rubric is then tailored to individual problems.

Included are the rationale for the approach that is taken, many examples of problems and sample student responses, and a nice discussion of how the overall "performance levels" (distinguished, advanced, basic, or novice) were set in 1994. No technical information is included.

(AL#000.3GUIMAE)

Hall, Greg. *Alberta Grade 9 Performance-Based Assessment—Math*, 1992. Available from: Greg Hall, Student Evaluation Branch, Alberta Education, Box 43, 11160 Jasper Ave., Edmonton, AB T5K 0L2, Canada.

The 1992 ninth grade math performance assessment used six stations with hands-on activities—students circulate through the stations. Testing time for each group of six students is 90 minutes. The six tasks involved rearranging squares to form different perimeters for the same area, measurement and mapping, surface area, collecting and graphing information, estimation, and combinations/permutations. Responses were scored using an analytical trait system having two dimensions: problem solving and communication. Each trait was scored on a scale of 0 (totally misunderstood or blank) to 3 (readily understood the task, developed a good strategy, carried out the strategy and generalized the conclusion). A few *possible* student responses are included to illustrate scoring, but no *actual* student responses are included. No technical information is included.

(AL#500.3ALBGRN)

Halpern, Diane (Ed.). *Enhancing Thinking Skills in the Sciences and in Mathematics*, 1992. Available from: Lawrence Erlbaum Associates, Publishers, 365 Broadway, Hillsdale, NJ 07642, (800) 926-6579.

This book is not strictly about assessment. Rather, it discusses the related topics of "What should we teach students to do?" and "How do we do it?" The seven authors "criticize the conventional approach to teaching science and math, which emphasizes the transmission of factual information and rote procedures applied to inappropriate problems, allows little opportunity for students to engage in scientific or mathematical thinking, and produces inert knowledge and thinking skills limited to a narrow range of academic problems." (p. 118). In general, they recommend that teachers focus on the knowledge structures that students should know, use real tasks, and set up instruction that requires active intellectual engagement. The authors give various suggestions on how to bring this about: instructional methods, videodiscs, group work, and a host more. The final chapter analyzes the various positions and raises theoretical issues.

(AL#500.6ENHTHS)

Harcourt Brace. *Stanford Achievement Test—Ninth Edition*, 1996. Available from: Order Fulfillment Dept., The Psychological Corporation, P.O. Box 839954, San Antonio, TX 78283, (800) 228-0752, fax (800) 232-1223.

The open-ended portion of the SAT-9 covers reading, math, science, social studies, and writing. It can be used alone or in conjunction with the multiple-choice portion. For reading, math, science, and social studies, there are 11 levels (2 forms each level) spanning grades 1.5-13. Writing has 9 levels (2 forms) across grades 3.5-13. All forms have 9 open-ended questions, some around a theme (for example, the theme of Primary 3, Math is the zoo) and

some not. Writing provides prompts for 4 types of writing: descriptive, narrative, expository, and persuasive. Scoring guides were not included in the materials we received. Norms are available. The documents we have include a sampling of the Stanford 9—open-ended assessments of various grade levels in reading, science, math, and/or writing.

(AL#060.3STAACT9)

Hartman, Charlotte. *Mathematical Power Opens Doors*, 1993. Available from: Vancouver School District, PO Box 8937, Vancouver, WA 98668, (206) 696-7011.

These open-ended mathematics problems supplement multiple-choice tests of content. The document we have contains: (1) a restatement of the "big" NCTM outcomes (problem solving, reasoning, communication, connections); (2) three sample problems in grade 6, and (3) a scoring guide (five traits: problem solving, communication, reasoning, math concepts and math procedures). A personal communication indicated that materials are used in two phases. First, several problems are done in a group to model how to proceed. Then, students choose three of five problems to do individually. No technical information or sample student performances are included.

(AL#500.3MATPOO)

Harvey, John G. *Mathematics Testing With Calculators: Ransoming the Hostages*. Located in: Mathematics Assessment and Evaluation: Imperatives for Mathematics Educators, Thomas A. Romberg (Ed.), 1992. Available from: State University of New York Press, State University Plaza, Albany, NY 12246.

This paper looks at the use of calculators in mathematics testing. The premise is that if we want students to investigate, explore and discover, assessment must not just measure mimicry math. Tests designed to *require* calculators are more likely to be able to do this. Additionally, it is important to incorporate calculators into the curriculum because in the technological world of the future, calculators will be essential. If we want teachers to use calculators in instruction, we need to incorporate them into testing. The author analyzes three types of test with respect to calculator use, describes things to consider when designing calculator tests, and describes current activity in developing "calculator-active" tests.

(AL#500.6MATTEC)

Herman, Joan L., Davina C. D. Klein, Sara Wakai, et al. *Assessing Equity in Alternative Assessment: An Illustration of Opportunity-to-Learn Issues*, 1995. Available from: CRESST-UCLA, 10880 Wilshire Blvd., Suite 700, Los Angeles, CA 90024, (310) 206-1532, fax (310) 794-8636.

As part of the administration of the 1993 California Learning Assessment System (CLAS), samples of teachers and students were surveyed to examine "opportunity to learn"—the

extent to which students have equal access to resources, quality instruction, extra-school opportunities, and preparation for the CLAS. Researchers sampled 13 schools from rural, urban, and suburban areas. The study included 27 teachers and over 800 students in eighth grade math classes. Survey, interview, and classroom observation forms are included. Questions include such things as: use of calculators, use of open-ended questions, practice with explaining thinking, and attitudes toward math. The paper concludes that there are differences among school types on some of these factors.

(AL#500.6ASSEQA)

Herman, Joan L., Davina C. D. Klein, Tamela M. Heath, et al. ***A First Look: Are Claims for Alternative Assessment Holding Up?—CSE Technical Report 391,*** **December 1994. Available from: National Center for Research on Evaluation, Standards, and Student Testing (CRESST), 10920 Wilshire Blvd, Suite 900, Los Angeles, CA 90024, (310) 206-1532, fax (310) 825-3883.**

The authors report on a study in which they looked at:

- The reaction of third grade students and their teachers to math performance assessments
- How performance assessments are administered in the classrooms
- The types of instruction and materials used by teachers
- The relationship between these things

Complete surveys, interview, and classroom observation forms are included.

(AL#500.6FIRLOA)

Holley, Charles D. and Donald F. Dansereau. ***The Development of Spatial Learning Strategies (Chapter 1),*** **pp. 3-15. Surber, John R.** ***Mapping as a Testing and Diagnostic Device (Chapter 10),*** **pp. 213-233. Located in: Charles D. Holley and Donald F. Dansereau, Eds.,** ***Spatial Learning Strategies—Techniques, Applications, and Related Issues,*** **1984. Available from: Academic Press, Inc., 6277 Sea Harbor Dr., Orlando, FL 32887, (800) 321-5068.**

This somewhat technical and formal paper describes the use of cognitive maps to assess student comprehension of concepts. Technical information is included.

(AL#150.6SPALES)

Hynes, Michael C. ***K-5 Mathematics Program Evaluation - A Florida Model Curriculum Project; School Handbook,*** **1993. Available from: University of Central Florida, College of Education, Orlando, FL 32816, (407) 823-6076.**

This handbook is intended to provide schools with the tools to assess K-5 mathematics programs in terms of student outcomes, program goals, curriculum, learning environment, learning resources, program support, evaluation, and equal access. The handbook includes sample instruments for each area. Most of these are surveys except for assessment of student outcomes.

Seventeen sample performance tasks (eight for primary and nine for grade 5) are included to assess various student outcome goals. These are open-ended (there is more than one correct answer) and most require explanations of, and rationale for, procedures used. Tasks do not use manipulatives—all are written and done individually. Performance is rated using a generic four-point scale—"Exemplary (Level A)" to "No Attempt (Level E)." An Exemplary response is one which: "Provides excellent responses in all areas of problem solving, reasoning, communication, connections, and mathematics content. Goes beyond the excellent category. Shows creative thinking, elegant communication, and/or unique approaches to the problem. Uses additional information to extend the solution." A sample student response for each score point is included to illustrate the scoring procedure.

The handbook includes a disk containing each of the instruments, a "School Report Card" and the scoring rubric. No technical information is included. The author has granted permission for educators to reproduce materials for use with students.

(AL#500.3K-5MAP)

Illinois State Board of Education. ***Effective Scoring Rubrics—A Guide to Their Development and Use,*** **1995. Available from: Illinois State Board of Education, Dept. of School Improvement Services, School and Student Assessment Section, 100 N. First St., Springfield, IL 62777, (217) 782-4823, fax (217) 784-6125.**

This short booklet provides a good overview of the characteristics of sound performance criteria (rubrics, scoring guides) and uses Illinois' writing and math rubrics as examples. The author values analytic/holistic, developmental, generalizable rubrics for the classroom.

(AL#150.6EFFSCR)

Illinois State Board of Education. ***Performance Assessment in Mathematics: Approaches to Open-Ended Problems*****, 1995. Available from: Illinois State Board of Education, Dept. of School Improvement Services, School and Student Assessment Section, 100 N. First St., Springfield, IL 62777, (217) 782-4823, fax (217) 784-6125.**

This document is a very concise and well written guide for assessing problem solving using open-ended problems. The document includes a nice definition of problem solving, criteria for writing open-ended problems (with samples illustrating different types), a sample three-trait rubric (math knowledge, strategic knowledge, and communication) for scoring student work, and 41 scored samples in grades 3, 8, and 10. This is one of my favorites. No technical information is included.

(AL#500.6PEROPE)

IOX. ***Assessing Mathematics Learning*****, 1997. Available from: IOX Educational Research and Development, 5301 Beethoven St., Suite 190, Los Angeles, CA 90066, (310) 822-3275, fax: (310) 822-0269.**

This 22-minute video briefly addresses three topics: (a) What standardized tests were designed to do and three common misues; (b) characteristics of good mathematics tests (improve student learning and results in valid inferences about student achievement), and (c) performance assessment (what it is, types, and a couple of words about rubrics). There are three places to pause the tape for group discussion. This tape is an overview only. More questions are raised than answered.

(AL#500.6ASSMALv)

Johnson, Judi Mathis. ***Portfolio Assessment in Mathematics: Lessons from the Field.*** **Located in: <u>The Computing Teacher</u> 21, March 1994, pp. 22-23.**

The author describes the results of a study in which she interviewed 20 successful math teachers. Her major conclusion is that math, assessment, and technology should not be competitors for teachers' attention, but components of a successful math classroom. Portfolios are used to both document and promote student learning and student responsibility for learning through self-reflection. Technology is used to learn concepts, produce work for the portfolios, and to produce the portfolio itself. Assessment is used to guide planning and influence instruction.

(AL#500.6PORMAL)

Katims, Nancy. *PACKETS Program: An Illustration of Classroom-Based Alternative Assessment*, 1994. Available from: Director, Office of School Services, Educational Testing Service, Princeton, NJ 08541, (609) 921-9000, fax: (609) 734-5410.

The author describes the *PACKETS* mathematics performance assessment exercises for grades 6-8, under development by Educational Testing Service (ETS). The document includes the rationale for the approach taken, two extended examples with samples of student work, and suggestions on how to use the samples in the classroom.

PACKETS activities try to pose a "big ideas" math problem in the context of developing a product for a client. Students read a context-setting newspaper article, discuss a set of readiness questions, and work together in groups of three for about two class periods. Students write-up their solutions and present them to the class. Students have the opportunity to revise after initial evaluation. Scoring is based on teacher observations (of group work and mathematical thinking) during the process of doing the activity; analyzing the math used; and evaluating the product for mathematical appropriateness, reasonableness of the solution, and appropriateness for the stated purpose. The document contains no scored student work and no technical information.

(AL#500.3PACKET)

Kentucky Department of Education. *Kentucky Instructional Results Information System (KIRIS)*, 1993-94. Available from: Kentucky Department of Education, Division of Accountability, 1900 Capital Plaza Tower, 500 Mero St., Frankfort, KY 40601, (502) 564-4394.

The *Kentucky Instructional Results Information System* is an assessment program that monitors student achievement (grades 4, 8, and 12) in reading, social studies, science, and mathematics. The assessment has three parts: multiple choice/short essay, performance assessment, and portfolios. Assessment results place students in one of four performance levels: novice, apprentice, proficient, or distinguished. The document we received contains grade 4, 8, and 12 performance assessment items in reading, social studies, science, and mathematics. All items are paper and pencil. Task-specific scoring guides are included.

(AL#060.3KIRIS94)

Kentucky Department of Education. *KIRIS Writing and Math Assessment Portfolio, 1993-94*. Available from: Kentucky Department of Education, Capitol Plaza Tower, 500 Mero St., Frankfort, KY 40601, (502) 564-4394.

This document contains some information related to Kentucky's 2993-95 writing and mathematics portfolios in grades 5, 8, and 12. General guidelines, an outline of the criteria

for judging quality, and folders are included. No background information, technical information, or samples of student work are included.

(AL#000.3KIRISWM)

Khattri, Nidhi. *Performance Assessments: Observed Impacts on Teaching and Learning,* 1995. Available from: Pelavin Associates, 2030 M St. NW, No. 800, Washington, DC 20036.

The author attempted to document the impact of performance assessment on teaching and learning. The author visited 14 schools in fall 1994 and spring 1995 to examine student work; observe in classrooms; and interview school personnel, students, and parents.

The authors report the following findings: "(1) students are being asked to write, to do project-based assignments, and to engage in group learning due to the use of performance assessments; and (2) as a result of project-based assignments, students are more motivated to learn. Furthermore, because of the use of performance-based assignments and the degree of freedom accorded to students in shaping their own work...collaboration is evident. Increasingly, teachers are viewing students as active learners. "

All of the effects depended on: (a) the form of the assessment (e.g., portfolio or performance event); (b) the degree of integration of the assessment into the classroom; and (c) the level of support provided to incorporate the assessment into routine classroom activities. The positive effects on teaching are most evident for sites using portfolio assessments, mostly because the portfolio format provides teachers and students control over products coupled with a structure for documenting student work and student progress on an ongoing basis.

(AL#150.6PERASO)

Kleinsasser, Audrey, Elizabeth Horsch, and Denise Wheeler. *Teacher-Researchers Investigating Science and Math Performance Assessments: Expanding Traditional Roles,* 1995. Available from: Audrey Kleinsasser, Box 3374, College of Education, University of Wyoming, Laramie, WY 82071.

The authors describe four teacher-researcher projects on the impact of the use of classroom-based performance assessments. The authors conclude that there is value in student-directed learning and assessment, and teacher-student assessment collaboration.

(TC#600.6TEAREI)

Kloosterman, Peter, and Frances K. Stage. ***Measuring Beliefs About Mathematical Problem Solving.*** **Located in: School Science and Mathematics 92, March 1992, pp. 109-115.**

The authors describe the development of a scale to assess student beliefs about mathematics. The instrument, designed for grades 7+, is called the *Indiana Mathematics Beliefs Scale.* Thirty-six questions cover six beliefs: (1) I can solve time-consuming mathematics problems. (2) There are word problems that cannot be solved with simple, step-by-step procedures. (3) Understanding concepts is important in mathematics. (4) Word problems are important in mathematics. (5) Effort can increase mathematical ability. (6) Mathematics is useful in daily life. The paper includes technical information based on studies with college students.

(AL#500.3MEABEM)

Knight, Pam. ***How I Use Portfolios in Mathematics*****, 1992. Located in: Educational Leadership 49, pp. 71-72. Also available from: Twin Peaks Middle School, Poway Unified School District, 14012 Valley Springs Road, Poway, CA 92064.**

The author describes her first year experimentation with portfolios in her middle school algebra classes. She had her students keep all their work for a period of time and then sort through it to pick entries that would best show: (1) effort and learning in algebra, and (2) activities that had been the most meaningful. There is some help with what she did to get started, and discussion of the positive effects on students. There is some mention of performance criteria, but no elaboration. One student self-reflection is included, but no technical information.

(AL#530.3HOWIUS)

Koretz, Daniel, Daniel McCaffrey, Stephen Klein, et al. ***The Reliability of Scores from the 1992 Vermont Portfolio Assessment Program—Interim Report,*** **December 1992. Available from: RAND Institute on Education and Training, National Center for Research on Evaluation, Standards, and Student Testing, UCLA Graduate School of Education, 10880 Wilshire Blvd., Los Angeles, CA 90024, (310) 206-1532.**

Beginning in 1990, RAND has been evaluating Vermont's portfolio assessment program. This paper reports on the study conducted during school year 1991-92. Basically, RAND found that interrater agreement on portfolio scores was very low for both writing and math. The authors speculate that this resulted from aspects of the scoring system, aspects of the operation of the program, and the nature and extent of training raters. This report provides good advise and caution for others setting up portfolio systems for large-scale assessment. (Note: A paper published in 1995 reports that with better training, scoring becomes more reliable.)

(AL#150.6INTRER)

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Koretz, Daniel, Brian Stecher, and Edward Deibert. ***The Vermont Portfolio Assessment Program: Interim Report on Implementation and Impact, 1991-92 School Year.*** **Available from: RAND Institute on Education and Training, National Center for Research on Evaluation, Standards, and Student Testing, UCLA Graduate School of Education, 10880 Wilshire Blvd., Los Angeles, CA 90024, (310) 206-1532.**

Beginning in 1990, RAND has been carrying out a multi-faceted evaluation of Vermont's portfolio assessment program. This paper reports on questionnaires and interviews conducted during school years 1990-91 and 1991-92. Results indicated that:

1. There was a significant impact on instruction, but teachers felt somewhat confused about what they were supposed to do.

2. The portfolios took a lot of classroom space and tended to be viewed by teachers as an add-on rather than as "the" instruction.

3. Teachers felt they knew more about students as the result of doing portfolios.

4. Students had some difficulty doing portfolio problems.

5. Reported effect on low achieving students was mixed.

(AL#150.6CANPOA)

Koretz, Daniel, Brian Stecher, Stephen Klein, et al. ***The Vermont Portfolio Assessment Program: Findings and Implications.*** **Located in: <u>Educational Measurement: Issues and Practice</u> 13, Fall 1994, pp. 5-16.**

The authors describe the Vermont portfolio assessment system, summarize key findings from a series of evaluations of the Vermont system, and discuss the implication of the findings for performance assessment in general. Although somewhat technical, the paper clearly points out the reliability and validity concerns surrounding the use of portfolios for large-scale assessment, and the tensions between using portfolios for large-scale assessment and using portfolios for instructional improvement. In short, portfolios are not magic and they have to be thoughtfully implemented. The paper presents a very thoughtful discussion of the issues.

(AL#000.6VERPOF)

Kulm, Gerald. ***Mathematics Assessment—What Works in the Classroom*****, 1994. Available from: Jossey-Bass Inc., Publishers, 350 Sansome St., San Francisco, CA 94104.**

This excellent book provides a good background for changes in assessment, has a great chapter on scoring rubrics, and provides good case studies of classroom alternative assessment use in grades 4-12.

(AL#500.6MATASW)

Lambdin, Diana V. and Vicki L. Walker. ***Planning for Classroom Portfolio Assessment.*** **Located in: Arithmetic Teacher, February 1994, pp. 318-324.**

The authors report on the development of a portfolio system for their secondary mathematics students. (This was part of a larger project for all grade 3-12 teachers.) The authors have students assemble a "permanent portfolio" from a "working portfolio." The working portfolio is a place to store all potential permanent portfolio entries. The permanent portfolio is assembled from the working portfolio. The goals are to promote student self-assessment, improve communication with students and parents, and gain a broader picture of the student than available with traditional tests. The goal is *not* to assess the breadth of student knowledge—this is done with traditional methods. The authors include task guidelines that are given to students.

In addition to student and peer evaluation of portfolio selections and the portfolio as a whole, the teacher has guidelines for grading based on diversity of selection, quality of written reflections about selections, and portfolio organization. The authors present a little detail that flesh out these criteria. The document includes some student work but no technical information.

(AL#500.3PLAPOA)

Lane, Suzanne. ***QUASAR Cognitive Assessment Instrument, (QCAI)*****, 1993. Available from: QUASAR (Quantitative Understanding: Amplifying Student Achievement and Reasoning), Learning Research & Development Center, University of Pittsburgh, 3939 O'Hara St., Pittsburgh, PA 15260, (412) 624-7791.**

The QCAI (QUASAR Cognitive Assessment Instrument) is designed to measure long-term growth of students in math thinking and reasoning. Information for this review was taken from several different papers (all of which are bound together in our collection).

Thirty-three tasks were designed for sixth and seventh graders. The tasks were designed to provide a good sample of math thinking and reasoning skills by using a variety of representations, approaches and problem strategies. Students were asked to provide a justification for a selected answer or strategy, explain or show how an answer was found, translate a problem into another representation (picture or equation), pose a mathematical

question, interpret provided data, and extend a pattern and describe underlying regularities. The tasks were field-tested. General descriptions for all the tasks and details on a few individual tasks are provided in these materials.

Scoring is done via a generalized holistic, four-point rubric which directs raters to consider mathematical knowledge, strategic knowledge and communication. (Each of these dimensions is laid out very clearly and could be used as the basis of an analytical trait scoring scale.) The generalized rubric is then tailored to individual problems by specifying features of responses that would fall at different scale points. The generalized scoring guide is included in these materials but not the task-specific adaptations.

(AL#500.3QUACOA)

Lawrence, Barbara. *Utah Core Curriculum Performance Assessment Program: Mathematics*, 1993. Available from: Profiles Corporation, 507 Highland Ave., Iowa City, IA 52240.

The Utah State Office of Education has developed 90 short-answer questions in mathematics, science and social studies (five in each of grades 1-6 for each subject) to complement multiple-choice tests already in place. Assessments are designed to match the Utah Core Curriculum goals. Although districts are required to assess progress toward these goals, the state-developed assessments are optional.

The mathematics assessments are designed to measure logical reasoning, number meanings, number operations, number representation, computation, estimation, algebra, data sets, probability, geometry, measurement, fractions, and patterns. Each task has several questions relating to a theme. Scoring is task-specific and based on the degree of correctness of the response. Points are totaled across tasks for each of the skill areas. Four levels of proficiency on each skill are identified: advanced, proficient, basic and below basic based on percent correct and behavioral descriptions of performance at each level.

The Office of Education has collected information on teacher reaction to the assessments from the field test. No other technical information is available at this time. A training video is available which helps teachers use the assessments.

(AL#500.3UTACOC and 000.6INTUTCv—*video*)

Lazear, David. *Multiple Intelligence Approaches to Assessment—Solving the Assessment Conundrum*, 1994. Available from: Zephyr Press, PO Box 66006-W, Tucson, AZ 85728, (602) 322-5090, fax: (602) 323-9402.

This manual discusses:

- Definitions and importance of seven student "intelligences."

- How to "kid watch" to determine which intelligences each student has strengths in.
- Ideas for using the "intelligences" profile to help kids get the most out of instruction.
- Ideas for developing students' weaker "inelligences."
- Criteria for sound assessment that include attention to both (a) assessing the seven intelligences, and (b) designing a variety of achievement measures that are couched in the terms of the seven intelligences.
- Lots of help on designing assessments in various content areas that capitalize on strengths in the various intelligences and allow students to show what they know in a variety of ways.
- The use of portfolios, journals, anecdotal records, and exhibits on the context of the seven intelligences.
- Ideas for getting started.
- Sample reporting formats that emphasize both development in the seven intelligences and development in the skills and knowledge through the seven intelligences.

I like the detail, specific examples, and easy readability of this one. There were lots of good ideas. Some readers might be put off by the seeming emphasis that developing the seven intelligences should be the *goal* of instruction rather than just the *means* of instruction and assessment. However, there is much here for either use.

(AL#000.6MULINA)

Leach, Eilene L. ***An Alternative Form of Evaluation that Complies with NCTM's Standards.*** **Located in: The Mathematics Teacher 85, November 1992, pp. 628-632. Also available from Centaurus High School, 10300 S. Boulder Rd., Lafayette, CO 80026.**

This teacher uses scored discussions to assess and promote problem solving, communicating mathematically, and group process skills in her high school math classes. She has three to six students face each other in front of the rest of the class and spend about five minutes trying to solve a problem. Individuals can earn positive points for such things as "determining a possible strategy to use," "recognizing misused properties or arithmetic errors," or "moving the discussion along." They can earn negative points by doing such things as: "not paying attention or distracting others," and "monopolizing."

The article has a thorough discussion of how the teacher sets up the classroom, introduces the procedure to students, scores the discussion, and handles logistics. The author also discusses the positive effects this procedure has had on students, and the additional insight she has obtained about her students.

All scoring is teacher-centered, but it wouldn't necessarily have to be. No technical information is included.

(AL#500.3ALTFOE)

Lehman, Michael. *Performance Assessment—Math*, 1992. Available from: Michael Lehman, Holt Senior High School, 1784 Aurelius Rd., Holt, MI 48842, (517) 694-2162.

This high school teacher gives six problems (some having only one right answer and some having more than one right answer) to solve as a team (four students per team). The team then spends an hour with a panel of three judges. Judges can ask any student to explain the team's solution and problem-solving strategy on any of the six problems. (Therefore, all students must have knowledge of all six problems.) Then the judges assign the team a new problem to work on while they watch. Student responses are scored on: making sense of the problem, solution strategies, accuracy of results, ability to communicate results, ability to answer questions posed by the judges, three judgments of group-process skills, and an overall judgment of student understanding.

A complete set of ten tasks (six pre-assigned, and four on-the-spot) are included for Algebra II. The scoring guide (a little on the skimpy side) and a few sample pre-calculus projects are also included. No technical information nor sample student performances are included.

(AL#500.3PERASM)

Lesh, Richard. *Computer-Based Assessment of Higher Order Understandings and Processes in Elementary Mathematics*. Located in: Assessing Higher Order Thinking in Mathematics, Gerald Kulm (Ed.), 1990. Available from: American Association for the Advancement of Science, 1333 H Street NW, Washington, DC 20005, (301) 645-5643.

This excellent article is as much about how meaningful learning occurs and the nature of the structure of knowledge in mathematics, as it is about use of computers in math instruction and assessment. The basic premise is that computer-based tests should not simply be pencil-and-paper tests delivered on-line. They should be part of an integrated instruction and assessment system that supports both learning facts and developing the meaningful internal structuring of these facts to form a coherent knowledge system.

The article discusses three things:

1. Principles underlying a modeling perspective of learning and assessment (ideas such as: learning and problem-solving situations are interpreted by the learner by mapping them to internal models, and several "correct" alternative models may be available to interpret a given situation)

2. Five objectives that should be emphasized in K-12 math (such as going beyond isolated bits of knowledge to construct well-organized systems of knowledge, and think about thinking)

3. Specific types of assessment items that can be used to measure these deeper and broader understandings (such as conceptual networks and interactive word problems)

Many sample problems are provided.

(AL#500.6COMBAA)

Lesh, Richard and Susan J. Lamon, Eds. *Assessment of Authentic Performance in School Mathematics*, 1992. Available from: American Association for the Advancement of Science, 1333 H St. NW, Washington, DC 20005.

This book contains articles by several authors on the topics of: assessment objectives—what should we assess; examples of assessments; classroom assessment; and scoring and reporting.

(AL#500.6ASSAUP)

Lester, Frank K. Jr., and Diana Lambdin-Kroll. *Assessing Student Growth in Mathematical Problem Solving*. Located in: Assessing Higher Order Thinking in Mathematics, Gerald Kulm (Ed.), 1990. Available from: American Association for the Advancement of Science, 1333 H Street NW, Washington, DC 20005, (301) 645-5643.

The authors maintain that a good assessment program in math should collect information about (1) affect (attitudes, preferences, and beliefs), (2) cognitive processes (both whether they get the right answer, and the strategies used), and (3) the features of tasks (problem type, math content, required strategies, etc.) since these affect performance and should be reflected in instruction. In order to gather information on these three categories of factors, the authors briefly discuss observations, interviews, student self-reports, and holistic and analytic scoring of performances. They recommend against multiple-choice questions.

This paper is a general theoretical discussion; no actual tasks, problems or scoring guidelines are provided.

(AL#500.6ASSSTG)

Linn, Robert L., Elizabeth Burton, Lizanne DeStefano et al. ***Generalizability of New Standards Project—1993 Pilot Study Tasks in Mathematics*****, 1995. Available from: Center for Research on Evaluation, Standards, and Student Testing, School of Education, University of Colorado, Campus Box 249, Boulder, CO 80309, (303) 492-8280.**

The authors report on a study in which they examined the ability to draw general conclusions about student skills from a small sample of performances. Their findings replicate those in other similar studies—more error is introduced into assessment results from the sample of tasks the student gets than from inconsistencies between raters when scoring. In other words, it is difficult to infer general student skill level from performance on a small number of tasks because student performance is not very consistent from task to task.

(AL#150.6GENNES)

Lokan, Jan, and Brian Doig. ***Performance Assessment, Australian Style or 'How Standard Can Standard Be?'*** **Paper prepared for the American Educational Research Association Annual Conference, New York, April 1996. Available from: Brian Doig, The Australian Council for Educational Research Ltd., 19 Prospect Hill Rd., Camberwell, Melbourne, Victoria 3124, Australia, phone 03-819-1400.**

This paper discusses Australia's experience in administering the Third International Math and Science Study (TIMSS) performance assessment. The authors conclude that the TIMSS performance assessment components "pass muster in logistics, costs, and issues," although use for describing the achievement of individual students is problematic. The actual performance assessment tasks are not described.

(AL#600.6PERASU)

Macomb Intermediate School District. ***Good Classroom Assessment Through Collegiality*****, 1995. Available from: Macomb Intermediate School District (MISD), 44001 Garfield Rd., Clinton Township, MI 48038, (810) 228-3309.**

This set of four high school "modules" is designed to prepare students for the Michigan proficiency test. Each module is (a) aligned with Michigan's proficiency standards, (b) covers many outcomes—number, data analysis, algebra, and geometry/measurement, and (c) has three types of questions—interactive (emphasizing problem solving and reasoning), multiple choice, and open-ended (emphasizing content understanding). Two of the four modules focus on algebraic ideas and the other two focus on geometry/measurement. Each module (although not individual items) are cross-referenced to Michigan's standards. All scoring is task-specific and right/wrong. There are no rubrics for assessing quality of

communication, problem solving, etc. It is unclear how to assign point values to answers, or how to combine scores between items. Each module has about 25 items.

(AL#500.3MACINS) IN-HOUSE USE ONLY

Madaus, George F. and Thomas Kellaghan. *The British Experience with 'Authentic' Testing*. Located in: Phi Delta Kappan 74, February 1993, pp. 458-459, 462-463, 466-469.

This paper presents a good summary of conclusions drawn from the performance assessment approach in England. Comments include:

- There are technical problems
- Lots of stress results
- Cost is high
- It is hard to manage

Nevertheless, there was value, and most staff felt it gave them food for thought about instructional practice. England is retreating from its approach.

(AL#000.6BRIEXA)

Maine Department of Education. *Maine Educational Assessment* [various documents], 1992, 1993, and 1994. Available from: Project Coordinator, Maine Educational Assessment, Department of Education, State House Station #23, Augusta, ME 04333, (207) 287-5991.

Information for this entry came from several documents: (1) "Guide to the Maine Educational Assessment," 1992-93; (2) " 1993-94 Supplement: Guide to the Maine Educational Assessment"; and (3) "Performance Level Guide, 1994-95, Elementary and Grade 8." The Maine Educational Assessment (MEA) has been in place since 1984. It assesses reading, writing, mathematics, science, social studies, health, and arts/humanities at grades 4, 8, and 11. Not all subjects are assessed in any given year. Students answer multiple-choice as well as more open-ended questions. On the science and math tests, all open-ended questions are paper and pencil-based (no hands-on activities) and all responses are in writing.

The math test covers procedural knowledge, conceptual knowledge, and problem solving in the various content strands of the NCTM curriculum standards. Some responses call for lengthier explanations than others. All work is scored using a holistic, 5-point (0-4) scale that emphasizes the correct solution, an appropriate strategy, and a solution shown with a correct label or description if necessary. This generalized rubric is then tailored to individual problems.

In science, assessments cover knowledge/comprehension and application knowledge, scientific inquiry, and the three content areas of life science, earth/space science, and physical

science. Student responses are scored on a five point (0-4) scale emphasizing completion of all important parts of the task, effective communication, indepth understanding of the relevant content and procedures, choice of more sophisticated procedures, and insightful interpretations of results. Once again, the general rubric is tailored to individual problems.

These documents describe the rationale for the approach that is taken, provide many examples of problems and sample student responses, and have a nice discussion of how they set overall "performance levels" (distinguished, advances, basic, or novice) in the spring of 1994. No technical information is included. (200 pp)

(AL#000.3GUIMAE)

Marshall, Sandra P. ***Assessing Knowledge Structures in Mathematics: A Cognitive Science Perspective.*** **Located in: Cognitive Assessment of Language and Mathematics Outcomes, Sue Legg & James Algina (Eds.), 1990. Available from: Ablex Publishing Company, 355 Chestnut St., Norwood, NJ 07648.**

This article discusses the use of cognitive research to develop assessment techniques that determine the extent to which students have acquired specific cognitive skills rather than merely whether they can correctly solve particular problems. Cognitive theory holds that people solve problems by using three knowledge structures—declarative (facts), procedural (algorithms and production rules), and schema (frames that relate facts and production rules). To solve a problem, a person must first find the right schema, must then correctly implement a set of production rules, and must have stored correctly the facts and knowledge required to carry out the necessary algorithms specified by the production rules. Errors in problem solving can result from any of these three areas.

Researchers are currently engaged in specifying these knowledge structures in such detail that they can develop computer simulations that can, first, solve problems, and second, reproduce student errors by leaving out or altering various parts of the necessary structures. In this way, errors in student responses can be tracked back to the erroneous structure used. The author specifically mentions work in the area of simple arithmetic operations, geometry, and word problems. Additionally, the author discusses two other ways of assessing student cognitive skills—reaction time (to assess how automatic a function is); and multiple-choice problems (e.g., "which of the following problems can be solved in the same way as the one stated above?" to get at schema knowledge). Some time is spent with multiple-choice problems to explore various types of problems and the technical issues that arise with them.

(AL#500.6ASSKNS)

Marshall, Sandra P. ***The Assessment of Schema Knowledge for Arithmetic Story Problems: A Cognitive Science Perspective*****, 1990. Located in: Assessing Higher Order Thinking in Mathematics, Gerald Kulm (Ed.). Available from: American Association for the Advancement of Science, 1333 H Street NW, Washington, DC 20005, (301) 645-5643.**

The *Story Problem Solver* (SPS) is based on a "schemata" theory of memory—human memory consists of networks of related pieces of facts, features, algorithms, skills, and/or strategies called schema.

The author teaches adult students taught five problem-solving schemas and how to recognize which schema is represented by a story problem. SPS is a computerized assessment method in which students pick out the schema or general solution strategy that fits a given story problem, decide which information in the story problem fits into the various parts of the schema, identify the steps needed to solve a problem, and decide whether the necessary information is given in the problem. Some of the schema shells and item types are given as examples. No technical information is included.

(AL#500.3ASSOFS)

Maryland Assessment Consortium. ***Performance Assessment Tasks Elementary Level, Volume 6*** **and** ***Performance Assessment Tasks Middle School, Volume 7*****, 1994-95. Available from: Jay McTighe, Maryland Assessment Consortium @ Frederick County Public Schools, 115 E. Church St., Frederick, MD 21701, (301) 694-1337, fax (301) 694-1800.**

The Maryland Assessment Consortium has published two notebooks of sample performance tasks in language arts, science, social studies, and mathematics. Some tasks are integrated across these areas. *Volume 6* contains 13 elementary tasks and *Volume 7* contains 9 middle school tasks. Each task includes complete instructions, test booklets and scoring guide, extension activities, special education modifications, and references. Tasks can include several steps or portions related to a theme, group work, hands-on activities, reading and interpreting materials, and/or writing. Performance criteria tend to be task-specific with separate criteria for each part of the task.

All tasks have been pilot-tested. No technical information nor sample student work are included. This document includes one sample elementary task and one sample middle school task. Full sets are available from the author.

(AL#000.3PERAST)

Maryland State Department of Education. ***Maryland School Performance Assessment Program: Resource Library—MSPAP Public Release Tasks: Planning a Zoo, Grade 3, Mathematics; School Fair, Grade 5, Mathematics;*** **and** ***Birth Dates, Grade 8, Mathematics;*** **July 1994. Available from: Maryland State Department of Education, Maryland School Performance Assessment Program, 200 W. Baltimore St., Baltimore, MD 21201, (410) 333-2000.**

This document contains a 1994 released math assessment booklet and scoring guide for each of grades 3, 5, and 8. Booklets consist of a scenario around which several related math activities are structured. For example, at grade 8 there are several questions related to the theme of birthdays. Some questions require only a short answer while others require more complex responses, e.g., drawing a graph, writing an explanation of an answer, or making predictions. Scoring is task-specific. The document contains tasks and scoring guides complete with sample student responses. No technical information is included.

(AL#500.3MSPAPM)

Maryland State Department of Education. ***Teacher to Teacher Talk: Student Performance on MSPAP (Maryland School Performance Assessment Program)*****, 1992. Available from: Gail Lynn Goldberg, Maryland Department of Education, Maryland School Performance Assessment Program, 200 W. Baltimore St., Baltimore, MD 21201, (410) 333-2000.**

This publication presents teacher reactions to their experience of scoring performance assessment tasks on the 1992 Maryland School Performance Assessment Program (MSPAP). The MSPAP covered reading, writing, math, social studies and science in grades 3, 5, and 8. Comments are organized by grade and subject. Most comments have to do with two topics: what teachers learned about students as the result of participating in the scoring, and how the performance tasks should be revised.

(AL#000.6TEATET)

Marzano, Robert J., Debra J. Pickering, Jo Sue Whisler, et al. ***Authentic Assessment*****, undated. Available from: Mid-Continent Regional Laboratory (McREL), 2550 S. Parker Rd., Suite 500, Aurora, CO 80014, (303) 337-0990.**

This document appears to be a series of handouts used in training. Although not specifically about math, the document does discuss some process outcomes related to math such as complex thinking, information processing, communication, etc.

Materials include definitions of assessment terms, a procedure for developing performance assessment tasks, and samples of tasks and scoring guides. The general approach is mix and match—tasks are meant to elicit several target behaviors on the part of students which are then scored with generic performance criteria. For example, a problem-solving task requires

students to draw a picture of their neighborhoods without using any circles or squares. Performances are scored for knowledge (geometry), complex thinking (ability to identify obstacles in the way of achieving desired outcomes), and effective communication (ability to express ideas clearly).

Sample tasks are in the areas of science, math and social studies. There are general mix-and-match scoring guides for: Knowledgeable Person, Complex Thinker, Information Processor, Effector Communicator/Producer, Self-Directed Learner, and Collaborative Worker. Scoring guides are a little skimpy. For example, one of the three traits included in the scoring guide for Skilled Information Processor is "effectively interprets and synthesizes information." To get a "4" (the highest score possible) the student "consistently interprets information gathered for tasks in accurate and highly insightful ways and provides synthesis of that information that are highly creative and unique." This is basically just a restatement of the trait title and provides no help with indicators of "consistent," "accurate," "insightful," or "creative.".

(AL#150.6AUTASS)

Massell, Diane. ***Setting Standards in Mathematics and Social Studies.*** **Located in: Education and Urban Society 26, February 1994, pp. 118-140.**

This article describes, analyzes, and contrasts two efforts to set curriculum standards—the National Council of Teachers of Mathematics (NCTM) efforts in math, and the state of California's efforts in history-social studies. It describes the history of development and provides ideas on what it takes to have a successful development effort.

(AL#000.5SETSTM)

Masters, Geoff, and Margaret Forster. ***Developmental Assessment—Assessment Resource Kit*****, 1996. Available from: Australian Council for Educational Research, 19 Prospect Hill Rd., Camberwell, Victoria, Australia, 3124, phone: +613 9277 5656, fax: +613 9277 5678**

This excellent publication clearly defines "developmental assessment" and systematically describes how to do it. Specifically, "developmental assessment is the process of monitoring a student's progress through an area of learning so that decisions can be made about the best ways to facilitate further learning. The unique feature of developmental assessment is its use of a progress map (or 'continuum'). A progress map describes the nature of development—or progress or growth—in an area of learning and so provides a frame of reference for monitoring individual development." The steps in "doing" developmental assessment are:

1. Construct a progress map (developmental continuum)

2. Collect evidence

3. Use the evidence to draw a conclusion about student development

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Many examples are provided. No technical information is included.

(AL#000.6DEVASA)

Mathematical Science Education Board, National Research Council. *Measuring Up—Prototypes for Mathematics Assessment*, 1993. Available from: National Academy Press, 2101 Constitution Ave, NW, Washington, DC 20418, (800) 624-6242.

Measuring Up is designed to illustrate performance assessment tasks that could be used with fourth graders to support reform efforts in mathematics instruction. The book presents 13 prototype assessments which are meant to be examples of assessment possibilities, not examples of ready-to-use assessments that provide an adequate sample of the NCTM standards.

The 13 tasks are nice. They take 1-3 class periods, require collaboration, require student explanations, have a series of questions related to a general activity, and have a single correct or best response (although a few are more open-ended). Some have Spanish translations. The "protorubrics" beginning scoring guides are not yet fully fleshed out. All are task-specific and use a three-point scale—high, medium, or low response. Abstracting across "protorubrics," the following types of things are included in the "high" category: correctness of response, evidence of conceptual understanding, flexibility of thinking, clarity of presenting results, and problem solving. (However, the "protorubrics" do not themselves identify their own content in this manner, nor do all include everything on this list.) The "protorubrics" are not, in themselves, sufficient to interpret results; the "rationale" section for each assessment is also necessary.

Tasks were pilot-tested to ensure that they work as intended. No other technical information is available. Many samples of student responses are included.

(AL#500.3MEAUPP)

McDonald, Joseph P., Sidney Smith, Dorothy Turner, et al. *Graduation by Exhibition—Assessing Genuine Achievement*, 1993. Available from: Association for Supervision and Curriculum Development, 1250 N. Pitt St., Alexandria, VA 22314, (703) 549-9110, fax (703) 549-3891.

This book describes a strategy for school reform called "planning backwards from exhibitions." In this approach, schools define a vision of what they want for graduates by proposing a task they want graduates to do well. Having set the vision, they have students perform the task and compare the vision against actual performance. Then they plan backwards what students would need to know and be able to do at various grades or ages in order to be able to do well on the final task. This booklet describes this process with three case studies, each proposing a different task "platform" against which they guage student

success—writing a position paper, inquiring and presenting, and participating in discussion seminars.

(AL#150.6GRAEXA)

McTighe, Jay. *Developing Performance Assessment Tasks: A Resource Guide*, October 1994. Available from: Maryland Assessment Consortium, c/o Frederick County Public Schools, 115 E. Church St., Frederick, MD 21701, (301) 694-1337.

This is a notebook of performance assessment "must reads." The authors have assembled their favorite papers on: definitions, overview of performance assessment, and designing performance tasks and criteria. The notebook also contains Maryland's learner outcomes.

(AL#150.6DEVPEA)

McTighe, Jay. *Teaching and Testing in Maryland Today: Education for the 21st Century*, 1992. Available from: Maryland Assessment Consortium, c/o Frederick County Public Schools, 115 E. Church St., Frederick, MD 21701, (301) 694-1337.

This 13-minute video is designed to introduce parents and community members to performance assessment.

(AL#150.6TEATEMv)

Mead, Nancy. *IAEP (International Assessment of Educational Progress) Performance Assessment (Science and Math)*, 1992. Available from: Educational Testing Service, Rosedale Rd., Princeton, NJ 08541, (609) 734-1526.

This document supplements the report by Brian Semple (also described in this bibliography) (AL#600.6PERASS). The document contains the administrators manual, scoring guide, equipment cards, and released items from the Second International Assessment of Educational Progress in science and mathematics.

(AL#500.3IAEPPA)

Medrich, Elliott A., and Jeanne E. Griffith. *International Mathematics and Science Assessments: What Have We Learned?*, 1992. Available from: National Technical Information Service, US Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161, (703) 487-4650.

This report provides a description of international assessments of math and science from the '60's to 1988, including findings and issues surrounding the collection and analysis of the

data. It also offers suggestions about ways in which new data collection procedures could improve the quality of the surveys and the utility of future reports.

(AL#000.6INTMAS)

Meltzer, L. J. *Surveys of Problem-Solving & Educational Skills*, 1987. Available from: Educator's Publishing Service, Inc., 75 Moulton St., Cambridge, MA 02138.

Although this is an individual test published primarily for diagnosing learning disabilities for students aged 9-14, it has some interesting ideas that could be more generally applied. There are two parts to the test—a more-or-less standard individualized aptitude test, and a series of achievement subtests. The math subtest involves a fairly standard test of computation. The interesting part comes in the scoring. Each problem is scored on choice of correct operations, ability to complete the word problem, efficiency of mental computation, self-monitoring, self-correction, attention to operational signs, and attention to detail (one point for evidence of each trait). After the entire subtest is administered, the teacher is guided through analysis of the student's strategies in completing the task—efficiency of approaching tasks, flexibility in applying strategies, style of approaching tasks, attention to the task, and responsiveness during assessment. A fair amount of technical information is included.

(AL#010.3SUROFP)

Miller, Edward, Ed. *The Push for New Standards Provokes Hope and Fear—and Both Are Justified.* Located in: The Harvard Education Letter 9, September/October 1993, pp. 1-6.

The author's position is that new standards, in and of themselves, will not reform or improve American education in math. We also need to pay equal attention to developing teachers' skills and to providing all students with equal opportunity to learn. Roadblocks to *real* reform include: (1) outmoded tests; (2) lack of teacher sophistication in math; (3) pressure to cover all the material in textbooks; (4) lack of time for planning and learning; and (5) lack of materials and resources. The article also includes other topics such as the need for standards that emphasize different skills and not just attaining higher levels of traditional skills, lessons from other countries, and vignettes demonstrating the various points made in the article.

(AL#500.5PUSNES)

Moen, Vivian, and Paul Weill. *Student Achievement Convention—1996-97; Guidelines for Grades K-12; Lane County, Eighth Annual.* Available from: Vivian Moen, Lane Education Service District, PO Box 2680, Eugene, OR 97402 (541) 461-8200, fax (541) 461-8298.

The Lane County Student Achievement Convention (previously called "Project Fair") has expanded to have several components:

- The Project Fair itself, which "provides an opportunity for students to display a major learning experience that combines content knowledge with process skills to produce a product or demonstration of learning."

- The Portfolio Exhibition, which "provides students an opportunity to show others how their academic experiences are preparing them for life and future work."

- The Video Festival, for students entering video productions as projects.

Entries come from any grade or content discipline. The "Guidelines" document includes application materials, description of project, portfolio and video submissions, and criteria for judging submissions. Projects, for example, require a progress journal, in which "ideas, thoughts, observations, questions, resources, problems, impressions or discoveries encountered in the process of working on the project should be recorded day-by-day," an annotated resource list, a self-evaluation of the project, and an exhibit. Projects are judged in three areas: topic and treatment (3 scores); learning development and process (4 scores); and communication (3 scores). This is an excellent document. No technical information or samples of student work are included.

(TC#000.3LANCOS)

Mt. Diablo Unified School District. ***Third Grade Curriculum-Based Alternative Assessment of Mathematics (CBAAM): A Report to Teachers*****, March 1995. Available from: Richard Nicoll, Mt. Diablo Unified School District, 1936 Carlotta Dr., Concord, CA 94519, (510) 682-8000, ext. 4135.**

These documents provide three scored student responses to several open-ended math problems given to third and sixth grade students during their 1995 math assessment. Students respond to three problems. Some are more right/wrong and some are more open-ended. Students explain their responses.

A generalized, holistic, six-point scoring guide is tailored to individual problems. (It is based on the rubric used in the CLAS statewide assessment.) In the generalized version, a "6" is: "Complete response with a clear, coherent, unambiguous, and elegant explanation; includes a clear and simplified diagram when appropriate; communicates effectively to the reader; shows understanding of the open-ended problem's mathematical ideas and processes; identifies all the important elements of the problem." The documents also include a rationale for alternative assessment, and the context for the Mt. Diablo assessment. No technical information is included.

(TC#500.3THIGRC)

Mullen, Kenneth B. *Free-Response Mathematics Test*, 1992. Available from: American College Testing Program, PO Box 168, Iowa City, IA 52240, (319) 337-1051.

This was a paper presented at the annual meeting of the National Council on Measurement in Education, San Francisco, April 1992.

This paper reports on a study by ACT that compares multiple-choice, open-response, and gridded response item formats on reliability, difficulty and discrimination. In gridded response items, students fill in their answers rather than choosing the answer from a given list. "Testlets" were designed to cover the same content and have the same test length for each format. Results indicated that all formats had about the same reliability; there was good rater agreement on the open-ended problems; and grid and open-ended problems discriminated better between students with different achievement levels. The correlation between performances on the various types of items ranged from 0.5 to 0.7. A few sample problems are provided. All open-response questions used scoring criteria that emphasize degree of correctness of the response and were tied to the task.

(AL#500.3FREREM)

Mumme, Judy. *Portfolio Assessment in Mathematics*, 1990. Available from: California Mathematics Project, University of California—Santa Barbara, 522 University Rd., Santa Barbara, CA 93106, (805) 961-3190.

This booklet describes what mathematical portfolios are, what might go into such portfolios, how items should be selected, the role of student self-reflection, and what might be looked for in a portfolio. Many student samples are provided. Criteria for evaluating portfolios include: evidence of mathematical thinking, quality of activities and investigation, and variety of approaches and investigations. No technical information is included.

(AL#500.6PORASI)

Myerberg, N. James. *Inter-rater Reliability on Various Types of Assessments Scored by School District Staff*, 1996. Available from: Montgomery County Public Schools, 850 Hungerford Dr., Room 11, Rockville, MD 20850.

This is a paper presented at the annual meeting of The American Educational Research Association in April 1996 in New York.

The author relates his district's attempts to craft their large-scale assessment so that teachers get more useful feedback. They feel that the best way to accomplish this is to have teachers score the assessments. However, the assessment information is also used for high-stakes decisions, so the information generated by the raters had to be highly reliable. The author discusses how they tried to balance these two goals in grades 3-8 and what happened. The

basic conclusion is that you can use teachers to score high-stakes performance assessments if training is careful and thorough. Technical information is included.

(AL#150.6INTREV)

National Board for Professional Teaching Standards. ***Adolescence and Young Adulthood/Mathematics—Standards for National Board Certification*****, November 1996. Available from: National Board for Professional Teaching Standards, 1730 Rhode Island Ave NW, Suite 909, Washington, D.C. 20036, (202) 463-3980.**

The National Board for Professional Teaching Standards (NBPTS) is developing a system for recognizing and rewarding accomplished teachers. To do this, they are:

- Establishing standards for what teachers should know and be able to do
- Develop a system to identify and reward teachers who meet those standards
- Advance related educational reforms

This document presents the standards for the Adolescent and Young Adulthood Mathematics certificate. "They represent a professional consensus on the critical aspects of practice that distinguish exemplary teachers in this field from novice or journeyman teachers." The 11 standards are:

1. Commitment to Students and Their Learning
2. Knowledge of Students
3. Knowledge of Mathematics
4. Knowledge of Teaching Practice
5. The Art of Teaching
6. Learning Environment
7. Reasoning and Thinking Mathematically
8. Assessment
9. Reflection and Growth
10. Families and Communities
11. Contributing to the Professional Community

The standards include a description of what it looks like when teachers are doing it well. Also included in the document is a description of the teacher assessment that leads to certification—a combination of a portfolio and a day at an assessment center.

(AL#500.5ADOYOA)

National Center for Research on Evaluation, Standards, and Student Testing (CRESST). *Assessing the Whole Child*, 1994. Available from: CRESST, Graduate School of Education, 145 Moore Hall, 405 Hilgard Ave., Los Angeles, CA 90024, (310) 206-1532.

This 17-minute video illustrates and describes one teacher's use of assessment in her third/fourth grade classroom. The teacher describes various assessment techniques, why she uses each, and what each shows about students; there are clips of how it looks when used in the classroom with students. The tape shows standardized tests, performance assessment, conferences, journals, and projects. The tape also shows criteria for choosing materials for math portfolios, student self-reflection, and student self-assessment. The teacher's basic philosophy is that the more we know students, the better able we are to help each succeed. This is a high quality production.

(AL#150.6ASSWHCt and AL#150.6ASSWHCv)

National Council of Supervisors of Mathematics (NCSM). *Great Tasks and More!!*, 1996. Available from: NCSM, PO Box 10667, Golden, CO 80401, (303) 274-5932.

One-hundred twenty tasks have been sorted into elementary, middle, and high school. Many are from the assessments of Kentucky, Oregon, NAEP, Measuring Up, California, and New Standards.

There is great variety in the tasks—complexity, group or individual, all paper and pencil v. hands-on, etc. There is an entire section labeled "Sample Performance-Based Final Exams." Generalized scoring rubrics from Oregon, Connecticut, California, New Jersey, Vermont, and Kentucky are included, as is a nice collection of articles.

All in all, this is a great resource. The one weakness is that there is little text to explain such things as why the various samples were chosen, how they vary, why they vary, and how/when to use the various rubrics. No student work nor technical information is included.

(AL#500.2GRETAM)

National Council of Teachers of Mathematics. *Mathematics Assessment: Alternative Approaches*, 1992. Available from: The National Council of Teachers of Mathematics, Inc., 1906 Association Dr., Reston, VA 22091.

This 71-minute videotape and guide are for professional educators who want to try new approaches to assessment, as described in the book *Mathematics Assessment: Myths, Models, Good Questions and Practical Suggestions*, by Jean Stenmark (also on this bibliography). The video has six segments (8-15 minutes each) that cover challenges that confront teachers through the school year as they try new approaches to assessment.

(AL#500.6MATASAv)

Newmann, Fred M., Walter G. Secada, and Gary G. Wehlage. *A Guide to Authentic Instruction and Assessment: Vision, Standards and Scoring*, 1995. Available from: Wisconsin Center for Educational Research, School of Education, University of Wisconsin, 1025 W. Johnson St., Madison, WI 53706, (608) 263-4200.

This is one of my favorites. The authors' premise is that innovative teaching techniques (e.g., cooperative learning, group discussions, hands-on experiments and videos) do not guarantee a change in the "intellectual quality" of what students are asked to do. For example, "a portfolio that shows a variety of student work over a semester might replace the final exam taken in one sitting, but the portfolio itself could be filled with tasks" devoted to remembering and listing isolated bits of information. Thus, the merit of any teaching technique should be judged by its ability to improve the "intellectual quality of student performance."

The paper is devoted to defining "intellectual quality," developing criteria for judging the intellectual quality of the school work students are asked to perform, for judging the intellectual quality of assessment tasks, and for assessing the intellectual quality of student work. The criteria are designed for use in *any* content area and thus serve to define delivery and performance standards across the curriculum and across teaching methods. Specific examples of the criteria are provided in math and social studies. Some samples of student work are included.

(AL#050.3GUIAUI)

New Standards. *Mathematics Reference Examination—Elementary, Middle* and *High School*, 1997. Available from: Harcourt Brace Educational Measurement, 555 Academic Ct., San Antonio, TX 78204, (800) 211-8378, fax: (800) 232-1223. Internet: www.hbem.com

The *New Standards Mathematics and English Language Arts Reference Examinations* at elementary, middle, and high school levels, provide a sampling of student performance in relationship to the New Standards. (They are not intended to measure the total range of the standards.)

The mathematics test is given in three 50-minute class periods. The exams include both short answer and extended response questions that target specific knowledge, as well as use of concepts and problem solving. Each test booklet also includes survey questions on classroom math experiences. Scoring instructions, sample student work, and technical information are not included in the materials we received. The examination is supplemented by a portfolio system (not included in this document).

(AL#500.3NEWSTM)

New Standards. ***Performance Standards, Volume 2—Middle School*****, 1997. Available from: Harcourt Brace & Company, 555 Academic Ct., San Antonio, TX 78204, (800) 211-8378**

For the New Standards project, good quality standards should (a) establish high standards for all students, (b) be rigorous and world class, (c) be useful, developing what is needed for citizenship, employment, and life-long learning, (d) be important and focused, parsimonious while including those elements that represent the most important knowledge and skills within the discipline, (e) be manageable given the constraints of time, (f) be adaptable, permitting flexibility in implementation needed for local control, state and regional variation, and different individual interests and cultural traditions, (g) be clear and usable, (h) be reflective of broad consensus, resulting from an iterative process of comment, feedback, and revision including educators and the general public.

(AL#000.5NEWSTPm)

New York State Education Department. ***Mathematics, Science and Technology Resource Guide*****, 1997. Located at: http://www.nysed.gov/mst/ Information available from: The Mathematics, Science, and Technology Resource Guide, Room 681 EBA, New York State Education Department, Albany, NY 12234. (518) 474-5922.**

This document, taken from the Internet, has three parts:

1. Elements essential in planning a standards-based mathematics, science, and technology curriculum

2. Examples of learning activities that bring standards alive in the classroom

3. Assessments aligned with standards

The focus is on New York State standards and state-level assessment plans, but many of the ideas are more broadly applicable. For examples, there is a nice part of the assessment section in which questions from the old Regents exams are rewritten to embody the new standards. The assessment section also includes pilot items from the new grades 4 and 8 state tests, and sample classroom assessments in grades 1, 8, and 10. Tasks are great; scoring mechanisms are a little skimpy.

(AL#000.6MATSCT)

Noble, Audrey J. and Mary Lee Smith. ***Old and New Beliefs About Measurement-Driven Reform: "The More Things Change, the More They Stay the Same," CSE Technical Report 373*****, April 1994. Available from: National Center for Research on Evaluation, Standards and Student Testing (CRESST), Graduate School of Education, UCLA Graduate School of Education, 405 Hilgard Ave., 1320 Moore Hall, Los Angeles, CA 90024, (310) 206-1532.**

The authors analyze the reasons for the failure of Arizona's large-scale performance assessment innovations. They cite:

- While beliefs about instruction and assessment changed, the negative consequences traditionally associated with large-scale assessment did not
- Test administration was timed, students could not work collaboratively, and teachers could not act as mediators
- Limited attention was given to staff development

The authors conclude, "Its (Arizona Student Assessment Program's) focus on compliance and control in effect undermines its potential to create the context necessary for educators to develop the level of competence desired by those who hope to reform education."

(AL#150.6OLDNEB)

North Carolina Department of Public Instruction. ***Linking Curriculum, Instruction, and Assessment: The Patterns, Relationships, and Pre-Algebra Strand, Grades 3-8 Mathematics*****, circa 1993. Available from: North Carolina Department of Public Instruction, 301 N. Wilmington St., Raleigh, NC 27601, (919) 715-1895.**

In 1989, North Carolina adopted the revised Standard Course of Study for Mathematics K-8. In 1991, the state began field testing open-ended and objective test items in grades 3-8 to be used as part of the end-of-grade tests. The new testing program emphasizes higher-order thinking and problem solving. In order to assist teachers to move to a new kind of instruction and assessment, this 60-page document was developed. It describes five to seven math objectives for each grade (3-8) and gives two sample test items (one multiple-choice and one open-ended) for each objective. Scoring on the open-ended problems uses a three- or four-point general rubric that is very sketchy. No technical information nor samples of student work are included. Some instructional ideas for each objective are provided.

(AL#500.3LINCUI)

Office of Educational Research and Improvement (OERI). ***Improving Math and Science Assessment. Report on the Secretary's Third Conference on Mathematics and Science Education*****, 1994. Available from: U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402**

This 15-minute video and companion booklet covers highlights of the *Secretary's Third Conference on Mathematics and Science Education: Improving Math and Science Assessment* during which more than 550 educators, researchers and policymakers gathered to talk about such questions as: Why must assessment change? What forms of math and science assessment can help American students succeed in these subjects? How can districts reforming assessment assure that tests are fair for students of all races and income levels and both genders? How can better assessments fuel the drive toward comprehensive reform of American education and higher academic standards? Recommendations, insights and information from the conference are incorporated into the video and the accompanying report.

(AL#000.6IMPMASv & 000.6IMPMASt)

Oregon Department of Education. ***First Reading Performance Standards—Certificate of Initial Mastery*****, June 18, 1996. Available from: Barbara Slimak, Oregon Department of Education, 255 Capitol St NE, Salem, OR 97310, (503) 378-3310, ext. 485, e-mail: barbara.slimak@state.or.us**

This document provides information (as of June 1996) about Oregon's Certificate of Initial Mastery and related state and classroom assessments in grades 3, 5, 8, and 10. Included are:

- Common questions and answers
- Sample multiple choice and open-ended questions in reading, speaking and math
- Some sample student work in writing and math
- Six-point analytical trait rubrics in writing, reading, speaking and math

(AL#060.6FIRREP)

Oregon New Standards Project. ***Student Portfolio Handbook—Quantify/ Science/ Mathematics—Field Trial Version/Elementary*****, 1994. Available from: Oregon Dept. of Education, Public Service Bldg., 255 Capitol St. NE, Salem, OR 97310, (503) 378-8004. Also available from: New Standards at the National Center on Education and the Economy, 39 State St., Suite 500, Rochester, NY 14614, (716) 546-7620, fax (716) 546-3145.**

This document describes the elementary science and mathematics portfolio student handbook developed by the Oregon New Standards Project. It is organized around the student goals for

Oregon's Certificate of Initial Mastery (CIM)—number sense, estimation, geography, measurement, statistics, patterns, physical, earth, space and life systems skills, science as inquiry, problem solving, interpreting results, connections, and communication. The document includes a description of these areas, examples of items that could be selected for the portfolio that demonstrate student ability in these areas, entry cover sheets, and a self-review checklist. Students are responsible for assembling their own portfolios. The document also includes draft scoring guides and a letter of introduction. No technical information or sample student work is included.

(AL#000.3STUPOQ)

Pandey, Tej. *Power Items and the Alignment of Curriculum and Assessment.* Located in: Assessing Higher Order Thinking in Mathematics, Gerald Kulm (Ed.), 1990. Available from: American Association for the Advancement of Science, 1333 H St. NW, Washington, DC 20005, (301) 645-5643.

The author presents a philosophy and approach for thinking about the development of a test of mathematics problem solving, and provides some examples of multiple-choice and short-answer "power" questions. The author maintains that typical content-by-process matrices used to specify the content of tests tend to result in tests that measure minuscule pieces of information that are fragmented and non-integrated. The author prefers to have assessment tasks that are broader in focus and cut across several process/content areas, so that in order to get the right answer, students must use skills like organizing information, representing problems, and using strategies.

(AL#500.6POWITA)

Paulson, Leon. *Portfolio Guidelines in Primary Math*, 1994. Available from: Multnomah County Educational Service District, PO Box 301039, Portland, OR 97220, (503) 255-1842.

This monograph provides some assistance with getting started with portfolios in the primary grades. The author believes that the most important purpose for mathematics portfolios is to prompt students to take control of their own learning. Therefore, the student should be in control of the portfolio. (The author, however, also points out that there might be other audiences and purposes for the portfolios that might have to be addressed.) The author provides some ideas for tasks that students could do to generate material for the portfolio, provides some very practical suggestions for getting started, gives ideas for activities to encourage student self-reflection, and shows some draft holistic criteria for evaluating portfolios.

An example of the user-friendly way this monograph provides practical help is: "Remember, the portfolio is telling a story. Each item in a portfolio is there for a reason. It should not require a mind reader to figure out why it is there. A portfolio entry includes a piece of work

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plus information that makes its significance clear—the reason it was selected, the learning goals illustrated, student self-reflections, and (always!) the date."

(AL#500.3PORGUP2)

Paulson, Leon, and Pearl Paulson. ***An Afternoon to Remember: A Portfolio Open House for Emotionally Disabled Students*****, 1992. Available from: Multnomah County Educational Service District, PO Box 301039, Portland, OR 97220, (503) 255-1842.**

Reynolds School District adapted Crow Island's "portfolio night" for use with severely emotionally disabled students. This paper describes how the afternoon was set up, what happened, student debriefing sessions, and changes in format based on student comments.

(AL#340.6AFTREP)

Pechman, Ellen M. ***Mathematics Assessment Process—Volume I: User's Manual*** **and** ***Volume 2: Assessment Instruments and Planning Guides*****, 1992. Available from: Association for Supervision and Curriculum Development, 1250 N. Pitt St., Alexandria, VA 22314**

MAP is an evaluation guide for assessing mathematics program needs and directing improvement for grades K-8. At the heart of the evaluation are nine "Criteria for Excellence" which describe characteristics of effective math programs:

- Curriculum that is problem centered
- Learning experiences designed to promote exploration and reasoning
- Emphasis on problem solving and critical thinking
- Resources that meet diverse learning needs
- Fosters a positive attitude toward math
- Relates learning to the real world
- Inspires collegiality
- Involves parents and the community
- Continually assesses student progress

The manual includes procedures and instruments for collecting, analyzing, and using information in these areas. Instruments include mathematics teacher interview, administrator interview, faculty interview, parent interview, student interview, mathematics classroom

observation, schoolwide observation, mathematics teacher survey, materials and facilities survey, and statistical profile. No technical information is included.

(AL#500.4MAPMAA)

Perlman, Carole. *The CPS Performance Assessment Idea Book*, November 1994. Available from: Chicago Public Schools, 1819 W. Pershing Rd., Chicago, IL 60609.

This wonderful handbook was developed to assist educators to develop performance assessments. Its most notable feature is a bank of over 90 sets of rubrics for assessing student performance in various grade levels and subject areas—reading, writing, mathematics, science, social studies, and fine arts. (Users need to be good consumers of these rubrics—presence doesn't necessarily imply recommendation. They are presented to provide ideas; few are perfect.) There are also well written sections on how to develop (and evaluate the quality of) rubrics and performance tasks.

(AL#000.3CPSPEA)

Pfeiffer, Sherron. *NIM Game Project*, 1994. Available from: Southeast EQUALS, 14 Thornapple Dr., Hendersonville, NC 28739, (704) 692-4078.

The assessment described in this document (appropriate for upper elementary and middle school students) asks students to create a game that requires application of math skills. (These projects are used after students have had many opportunities to work with different kinds of NIM games.) Projects become part of a portfolio that shows growth over time. The projects are scored using tasp-specific criteria that emphasize the quality of the game and its usefulness in teaching the math skills specified. Project instructions and scoring guide are included. Also included is (a) lots of help on how to use NIM games with students, (b) 10 HIM games developed by others, and (c) a general discussion of the characteristics of worthwhile instructional tasks. No sample student work nor technical information is included.

(AL#500.3NIMGAP2)

Porter, Andrew C. *Standard Setting and the Reform of High School Mathematics and Science*, 1995. Available from: Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison, 1025 W. Johnson St., Madison, WI 53706, (608) 263-4200.

The author reports on a study that looks at the effects of increased enrollment in academic classes resulting from raising course-taking graduation requirements. Previous studies discovered that increased graduation requirements did not raise dropout rates and that, indeed, students were taking more academic classes, especially science and math. This study examined whether the affected academic courses were "watered down" to accommodate

weaker and less motivated students. The author found that courses were not watered down. The conclusion is that standards for high school students have, indeed, been raised.

(AL#000.6STASER)

Pritchard, Diane. *Student Portfolios—Are They Worth the Trouble?*, 1992. Available from: Sisters Middle School, PO Box 555, Sisters, OR 97759, (503) 549-8521.

This paper was written by a middle school math and English teacher. It provides practical help with how to set up a portfolio system in math by describing her purpose for having a portfolio, the types of activities included, and activities to get students to self-reflect (including an idea for tests).

(AL#500.3STUPOT)

Psychological Corporation, The. *Alternative Model Assessment Package (AMAP)—Mathematics*, 1993. Available from: The Psychological Corporation, Order Service Center, PO Box 839954, San Antonio, TX 78283, (800) 228-0752, fax (512) 270-0327.

The AMAP package consists of mathematics and language arts performance tasks for students in grades 3-10. The math tasks consist of a series of questions on a common theme. For example, in the level 5 task, students use ratios to determine dimensions for flags. Each task takes two 1-hour class periods. Students work individually. Student responses to the investigation are scored as a whole—the various parts and steps do not receive separate scores. A six-point holistic rubric is used—only one score is given. The rubric emphasizes completeness, communication, relevance, logic, and computation. This document includes one sample task plus administration instructions and a scoring guide. No sample student work nor technical information is included.

(AL#500.3AMAP-M)

Psychological Corporation, The. *GOALS: A Performance-Based Measure of Achievement*, 1992. Available from: The Psychological Corporation, Order Service Center, PO Box 839954, San Antonio, TX 78283, (800) 228-0752.

GOALS is a series of short-answer questions that can be used alone or in conjunction with the MAT-7 or SAT-9. Three forms are available for 11 levels of the test covering grades 1-12 in the subject areas of science, math, social studies, language and reading. Each test (except language) has ten items. The manual states that the math questions assess student problem solving, communication, reasoning, connections to other subjects, estimation, numeration, geometry, patterns, statistics, probability and algebra. The manual draws the distinction between the approach taken in *GOALS*, and the related publication "Integrated Assessment System" which has fewer tasks pursued in more depth.

Responses are scored on a scale of 0-3, where 0 is "response is incorrect" and 3 is "accurate and complete with supporting information." Scoring can be done locally or by the publisher. There is good assistance with scoring philosophy and procedures. There are two sample student performances for each score point for each question. The scores are combined across tasks to provide indicators of conceptual understanding, problem solving, and procedure use. These are not, however, scored directly. Rather, it is analogous to multiple-choice tests in which scores on individual questions are combined to give subtest scores.

Both norm-referenced (percentiles) and criterion-referenced (how students perform on specific concepts) score reports are available. A full line of report types (individual, summary, etc.) are available. The materials we obtained did not furnish any technical information about the test itself.

(AL#510.3GOALS)

Psychological Corporation, The. ***Integrated Assessment System: Mathematical Performance Assessment*****, 1991. Available from: The Psychological Corporation, Order Service Center, PO Box 839954, San Antonio, TX 78283, (800) 228-0752.**

Two task booklets are provided for each of grades 2-8 (14 in all). Each task booklet presents a series of questions around a theme. For example, various task booklets focus on symmetry, breaking a tie in an election, planning an orchard to maximize yield, and bar codes. Questions involve such things as figuring out an answer and explaining how the solution was reached, and generating a principle and applying it to a new situation.

Solutions are scored either holistically (0-6) or analytically (four, 4-point scales). The performance criteria represent generalized features of problem solving and so can be used to score performance on any task. The holistic scale covers quality of work, evidence of understanding of concepts, logical reasoning, and correct computations. The analytical traits are: reasoning, conceptual knowledge, communication, and procedures. Scoring can be done either locally or by the publisher.

The set of materials we obtained includes a brief description of the scoring rubrics and one example of a scored student test. Technical information was not included.

(AL#500.3INTASM)

Reese, Clyde M., Karen E. Miller, John Mazzeo, et al. ***NAEP 1996 Mathematics Report Card for the Nation and the States—Findings from the National Assessment of Educational Progress*****, February 1997. Available from: U.S. Government Printing Office, Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402.**

The 1996 NAEP mathematics assessment consisted of multiple-choice, short answer (2 minutes), and extended answer (5 minutes) questions. These questions were designed to

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cover five content strands (statistics, algebra, number operations, measurement, and geometry). Questions were designed to cover a range of cognitive levels and skills including conceptual understanding, procedural knowledge, and problem solving. The constructed response questions were scored holistically on a 3- or 4-point scale (complete, satisfactory, ?). Complete definitions of the scale are not provided.

Questions were mix and matched into various test forms that also included student background questions (race, level of parental education, homework, academic expectations, etc.), questions about math activities (courses taken, instruction, attitude toward math), etc., and student opinions of the 1996 assessment (difficulty, motivation to do well, etc.).

Results from the assessment are promising with scores at all grade levels increasing. The report includes sample questions, student work, and a detailed report of results. Complete technical information is available.

(AL#500.6NAEP96b)

Regional Educational Laboratory Network Program. ***Improving Science and Mathematics Education—A Toolkit for Professional Developers: Alternative Assessment*****, 1994;** ***Addendum*****, 1995. Available from: Document Reproduction, Northwest Regional Educational Laboratory, 101 SW Main St., Suite 500, Portland, OR 97204, (503) 275-9519, fax (503) 275-0458.**

The *Toolkit* was designed cooperatively by all 10 regional labs as a teacher professional development resource. It is a compilation of activities and supportive materials that serve both as an alternative assessment resource and a means of engaging teachers in dialogue about changing the way mathematics and science have traditionally been taught and assessed. The *Toolkit* contains:

- Information and professional development activities on the topics of: rationale for alternative assessment, integrating assessment and instruction, design options for alternative assessment, being a critical consumer of assessments, grading/reporting, and planning effective professional development
- Twenty-six sample assessments
- Articles on grading and reporting

An update of the *Toolkit* is due early in 1998. It will include about 50 sample assessments in math, science, reading, writing, speaking, and social studies; new and revised training activities; and samples of student work in a variety of grade levels and subject areas.

(AL#000.6TOOKIP2a and AL#000.6TOOKIP2c)

Rhode Island State Assessment Program. ***1996 Mathematics Assessment: A Guide to Interpretation.*** **Available from: Rhode Island Department of Education, 255 Westminster St., Providence, RI 02903, (401) 277-4600, fax (401) 351-7874**

The spring 1996 grade 4 Rhode Island mathematics assessment included locally developed, open-response questions in addition to a norm-referenced, standardized test. This document describes the assessment process and includes scored student responses for two of the open-response questions. The two tasks both had a single best answer; one was all paper and pencil while the other required manipulatives. Scoring is task specific.

The booklet includes implications for instruction, including checklists for teachers to self-assess the extent to which their instruction reflects current thinking about good mathematics instruction. The booklet also includes Rhode Island's guidelines for accommodations. No technical information is included.

(AL#500.3RHOISS)

Riverside Publishing Company, The. ***California Program for Learning Assessment—Mathematics Performance Assessments,*** **1994. Available from: The Riverside Publishing Company, 8420 Bryn Mawr Ave., Chicago, IL 60631, (800) 323-9540.**

The *California Program for Learning Assessment* addresses language arts and mathematics in eight levels for grades 3-10. The math tests are designed to be given in 45 minutes and have two parts. Part 1 contains two open-ended math problems which take approximately 30 minutes to complete. Part 2 has seven multiple-step, multiple-choice problems which take approximately 15 minutes to complete. The test is designed to assess problem solving, application of knowledge, and communication skills rather than knowledge of specific facts or operations. The open-ended problems require written responses and are completed individually. Both open-ended and multiple-choice questions are thought-provoking.

Open-ended responses are scored using a 0-4 point, generalized, holistic rubric where "4" "Shows a complete understanding of the problem and addresses all relevant mathematical ideas; exhibits sound reasoning and draws logical conclusions; communicates clearly through the use of appropriate charts, graphs, diagrams, illustrations, and/or words; provides computation (where required) adequate for the solution of the problem." Although somewhat sketchy, this rubric attempts to address the process outcomes in the NCTM standards. To help the scorer, the general rubric is tailored to each particular problem.

The materials we received mention a pilot test in 17 California schools, but no details are given.

(AL#500.3CALPRL) IN-HOUSE USE ONLY

Romberg, Thomas A. ***Assessing Mathematics Competence and Achievement*****, 1989. Available from: National Center for Research in Mathematical Sciences Education, Wisconsin Center for Educational Research, University of Wisconsin, School of Education, 1025 W. Johnson St., Madison, WI 53706, (608) 263-4200.**

This paper describes the author's view of what it means to be literate mathematically. It then describes the instructional and assessment implications of this goal. The author believes that we need to assess not only mathematical knowledge but also the structure of the knowledge.

(AL#500.5ASSMAC)

Romberg, Thomas A. ***The Domain Knowledge Strategy for Mathematical Assessment*****, 1987. Available from: National Center for Research in Mathematical Sciences Education, Wisconsin Center for Educational Research, School of Education, 1025 W. Johnson St., Madison, WI 53706, (608) 263-4200.**

This document provides a brief overview of the "Domain Knowledge" strategy used by the National Center for Research in Mathematical Sciences Education to assess math knowledge of students. This approach is contrasted to the typically used "Content by Behavior Matrix" approach in which content topics are crossed with behavior (usually some form of Bloom's taxonomy). The author maintains that this approach is outdated; the behavior dimension fails to reflect contemporary notions of how information is processed and the content dimension is an inadequate way to describe what is meant by "knowing mathematics."

The "Domain Knowledge" approach involves making a "map" or network of a concept domain. This reflects a more integrated and coherent picture about knowledge. These maps can be used to generate tasks, assessment criteria, and formats that get at both "correctness" of responses and the strategies used to arrive at the answer.

(AL#500.6DOMKNS)

Romberg, Thomas A. ***Mathematics Assessment and Evaluation: Imperatives for Mathematics Educators*****, 1992. Available from: State University of New York Press, State University Plaza, Albany, NY 12246.**

This book covers several interesting topics with respect to assessment in math. Specifically:

1. How tests communicate what is valued
2. How "traditional" tests will not promote the recommendations in the NCTM standards
3. Various considerations when developing tests: calculators, how to adequately model knowledgeable students, etc
4. Setting up assessment that is intended to influence instruction

Although authoritative, this book is written in a very academic style, which makes it less accessible to general readers. Articles that are most relevant to this bibliography are entered separately.

(AL#500.6MATASE)

Romberg, Thomas A., and Linda D. Wilson. ***Alignment of Tests with the Standards.*** **Located in: Arithmetic Teacher, September 1992, pp. 18-22.**

The authors make the argument that teachers teach to tests. Therefore, if we want the NCTM standards to be implemented we need to have tests that reflect the standards. The authors feel that many current norm-referenced tests do not match the standards. Finally, they present tasks from several innovative assessments that they feel do reflect the standards.

(AL#500.6ALITEW)

Romberg, Thomas A., E. Anne Zarinnia, and Steven R. Williams. ***The Influence of Mandated Testing on Mathematics Instruction: Grade 8 Teachers' Perceptions*****, 1989. Available from: National Center for Research in Mathematical Sciences Education, Wisconsin Center for Educational Research, School of Education, 1025 W. Johnson St., Madison, WI 53706, (608) 263-4200.**

This monograph reports on the first of a sequence of studies on mandated testing in mathematics. This study was a large-scale questionnaire survey to find out from Grade 8 teachers how influential mandated testing was on their teaching of mathematics. The results of the study showed that nearly 70 percent of the teachers reported that their students take a mandated test. Secondly, because teachers know the form and character of the tests their students take, most teachers make changes in their teaching to reflect this knowledge. Third, the kinds of changes teachers make are in contrast to the recommendations made by the NCTM standards. Specific examples are given. Although this paper does not describe an alternative assessment device, it does provide reasons for seeking alternative ways of assessing math.

(AL#500.6INFMAT)

Ryan, Peter. ***Teacher Perspectives of the Impact and Validity of the Mt. Diablo Third Grade Curriculum-based Alternative Assessment of Mathematics (CBAAM)*****, September 1994. Available from: Far West Laboratory for Educational Research and Development, 730 Harrison St., San Francisco, CA 94107, (415) 565-3000.**

This report discusses the impact of math assessment reform in a California school district. The research looked at impact on the instruction delivered by third grade teachers, impact on teacher professional development, and impact on teacher attitudes. Results of the survey and interviews showed that the assessment has an impact on changing instruction (both content

and process), legitimized changes teachers had already made, communicated with parents, and teacher self-reflection.

Included in the report are the 1994 third grade assessment booklet, and the teacher survey and interview forms. The third grade assessment includes both short answer (scored right/wrong) and more complex problems (which also require communication).

(AL#500.3TEAPEI)

Schoenfeld, Alan H. *Teaching Mathematical Thinking and Problem Solving*. Located in: Toward the Thinking Curriculum: Current Cognitive Research, Loren B. Resnick & Leopold E. Klopfer (Eds.), 1989. Available from: Association for Supervision and Curriculum Development, 1250 N. Pitt St., Alexandria, VA 22314-1403, (703) 549-9110.

Although this article is more about defining what mathematical problem solving is than about assessment, it presents an interesting visual way to represent how students spend their time when solving a problem. It also compares a plot of time use for a good problem solver to a plot for an inefficient problem solver. Essentially, the plotting procedure involves tracking the sequence in which people use different steps in the problem-solving process (reading the problem, analyzing the problem, exploring a solution strategy, planning, implementing a strategy, and verifying the results) and the amount of time spent on each. Good problem solvers spend a lot of time analyzing and planning, with many self-checks on "how it is going." Poor problem solvers tend to fixate on a possible line of attack and pursue it relentlessly even when it is clearly not going well. Additionally, there are very few stops to self-check on how it is going.

(AL#500.5STOWTET)

Schwartz, Judah L., Joan M. Kenney, Kevin A. Kelly, et al. *Assessing Mathematical Understanding and Skills Effectively*, 1995-96 Edition. Available from: Educational Technology Center, Harvard Graduate School of Education, Nichols House, Appian Way, Cambridge, MA 02138, (617) 495-9373.

The authors have compiled a bank of over 250 math tasks on CD-Rom for grades 4, 10, and 12. Each task is classified in two ways:

1. By "content area": number/quantity, shape/space, pattern function, chance/data, and arrangement

2. By "process": modeling/formulating, transforming/manipulating, inferring/drawing conclusions, and communicating

The CD-Rom includes rubrics for many of the tasks (task specific), solution discussions, and for the technology tasks, software and spreadsheet data. Some projects are included. There is a hard-copy presentation of all tasks, without rubrics.

The hard copy contains no discussion of the rationale for the classification scheme nor for how tasks were developed. This resource would be best used by those who have such rationales already in mind and are looking for implementation ideas.

(AL#500.2ASSMAU) IN-HOUSE USE ONLY

Secada, Walter G., Sherian Foster, and Lisa Byrd Adajian. ***Intellectual Content of Reformed Classrooms.*** **Located in: NCRMSE Research Review 4, Winter 1995, pp. 3-8. Available from: National Center for Research in Mathematical Sciences Education, Wisconsin Center for Education Research, University of Wisconsin, 1025 W. Johnson St., Madison, WI 53706, (608) 263-7582, fax (608) 263-3406.**

As part of a study on reform in mathematics education, the authors are developing a classroom observation form containing indicators of the classroom's "intellectual substance." There are 10 scales intended to describe a lesson's content in terms of teacher and student behavior, student engagement, and the shared norms of the class revealed through the interaction patterns of the class. The 10 scales are:

- Mathematical Concepts—the content of the lesson
- Use of Mathematical Analysis—student engagement in analytical math beyond rote uses of algorithms, e.g., searching for math patterns, making math conjectures, or justifying conjectures
- Depth of Knowledge and Student Understanding—the depth of student knowledge being developed in a lesson
- Mathematical Connections
- Cross-Disciplinary Connections—
- Value Beyond the Class
- Mathematical Discourse and Communication—the degree to which talking is used to understand math
- Locus of Mathematical Authority—the extent to which authority is shared with students
- Social Support for Student Achievement—conveying high expectations
- Student Engagement in Doing Mathematics—student motivation

The article includes a description of the scales and a sample classroom example but no detail on scoring and no technical information.

(AL#500.4INTCOR)

Semple, Brian McLean. ***Performance Assessment: An International Experiment*****, 1991. Available from: Educational Testing Service, The Scottish Office, Education Department, Rosedale Rd., Princeton, NJ 08541, (609) 734-5686.**

Eight math and eight science performance tasks were given to a sample of thirteen-year-olds in five volunteer countries (Canada, England, Scotland, USSR, and Taiwan). The 16 hands-on tasks are arranged in two 8-station circuits. Students spend about five minutes at each station performing a short task. Most tasks are "atomistic" in nature; they measure one small skill. For example, the math tasks concentrate on measuring length, angles, and area, laying out a template on a piece of paper to maximize the number of shapes obtained, producing given figures from triangular cut-outs, etc. Only a few tasks require students to provide an explanation of what they did. All 16 tasks are included in this document, although some instructions are abbreviated and some diagrams are reduced in size. the complete tasks, administration and scoring guides are available from ETS.

Most scoring is right/wrong; student explanations are summarized by descriptive categories. There is also observation of the products of students' work. Student summary statistics on each task are included. There is a brief summary of teacher reactions, student reactions, the relationship between student performance on various tasks, and the relationship between performance on the multiple-choice and performance portions of the test. A few sample student performances are included.

(For related information, see Nancy Mead, also listed in this bibliography.)

(AL#600.3PERASS)

Serrano, Claudia. ***A Look at Portfolio Assessment in San Diego High School's Sophomore House*****, 1991. Available from: San Diego City Schools, 4100 Normal St., Room 3133, San Diego, CA 92103, (619) 298-8120.**

This paper describes an interdisciplinary (physics, math, and English) portfolio system for tenth graders that supports block scheduling in an inner city magnet school. Students keep a notebook of all work in each class. Class portfolios are developed from selected work in the notebook. Class portfolios are used as the basis for the culminating "House Portfolio" in which students select work to demonstrate that they have attained specified learning goals. The "House Portfolio" also includes written reflection and a final exhibition of mastery.

The document includes student instructions for assembling the portfolio, an entire student portfolio, instructions for a formative oral presentation of their portfolio, checklists and evaluation forms, and assistance with reflective writings and exit exhibitions. No technical information is included.

(AL#000.3LOOPOA)

Shepard, Lorrie A., Robert J. Flexer, Elfrieda H. Hiebert, et al. ***Effects of Introducing Classroom Performance Assessments on Student Learning.*** **Located in: Educational Measurement: Issues and Practice 15, Fall 1996, pp. 7-18.**

The purpose of the study described in this article is to "examine the effects of performance assessments on student learning." The study was done with 13 third-grade classrooms in reading and math. The authors found that "introducing performance measures did not produce immediate and automatic improvements in student learning." They urge reformers to

> ...take seriously the need for sustained professional development to implement a thinking curriculum. Performance assessments—even with the diligent effort of most project teachers and commitment of four university researchers—did not automatically improve student learning. When positive changes did occur, however, they supported our beliefs that less able students can develop conceptual understandings presently exhibited by only the most able students—if only they are exposed to relevant problems and given the opportunity to learn. Performance assessments that embody important instructional goals are one way to invite instructional change, and assessments have the added advantage of providing valuable feedback about student learning. However, we would not claim that performance assessments are necessarily the most effective means to redirect instruction. When teachers' beliefs and classroom practices diverge from new conceptions of instruction, it may be more effective to provide staff development to address those beliefs and practices directly. Performance assessments are a key element in instructional reform, but they are not by themselves an easy cure-all.

(AL#150.6EFFINC)

Seeley, Marcia M. ***The Mismatch Between Assessment and Grading.*** **Located in: Educational Leadership, October 1994, pp. 173-175.**

The author describes some of the dilemmas faced by math teachers when they attempt to integrate alternative assessments with letter grades.

(AL#150.6MISBEA)

Stenmark, Jean Kerr. ***Mathematics Assessment: Myths, Models, Good Questions, and Practical Suggestions*****, 1991. Available from: National Council of Teachers of Mathematics, 1906 Association Dr., Reston, VA 22091.**

This monograph was designed for teachers in the elementary grades. It is a collection of examples of assessment techniques that focus on student thinking. Topics include the rationale for new ways of assessing mathematics, the necessity of integrating assessment and instruction, designing performance assessments (most emphasis is on designing the task, although sample holistic and analytical trait scoring systems are shown), what to look for during classroom observations and interactions (including questions to ask to get at various types of thinking), portfolios (including types of items to include and the types of information they can demonstrate about students, and criteria for evaluation), student self-

assessment, and hints to make assessment work in the classroom. No technical information is provided.

(AL#500.3MATASM)

Sternberg, Shari, and Gale Waibel. *Challenging Mathematics Problems that Stretch Students' Thinking*, 1995. Available from: Shari Sternberg, 1310 Pennington Ln., Bowie, MD 20716 or Gale Waibel, 704 Bromley St., Silver Spring, MD 20902.

The authors present 30 "challenge" problems on mathematics (10 for grades 1-2, 10 for grades 3-4, and 10 for grades 5-6), including cross references to the Maryland Department of Education's mathematics domains, scoring guides, and an exemplary student solution. All scoring is task-specific. No technical information is included.

(AL#500.3CHAMAP)

Stuart Foundations Project Teachers. *Language Arts and Science Performance Assessment Sampler, 1993.* Available from: San Diego City Schools, 4100 Normal St., Room 3133, San Diego, CA 92103, (619) 298-8120.

This document includes 12 performance assessment project tasks developed by teachers for students in grades K-3 and 4-8. Some of the tasks are interdisciplinary (science, math, writing,) and some are subject specific (mostly writing). The tasks themselves are interesting and may provide ideas for others developing performance assessments. This document does not include rationale or context for the tasks, technical information, or sample student work. The performance criteria listed for each project are sketchy.

(AL#100.3LANARS)

Surber, John R., Philip L. Smith, Frederika Harper. *MAP Tests*, 1981. Available from: John R. Surber, University of Wisconsin-Milwaukee, Department of Educational Psychology, Milwaukee, WI 53201, (414) 229-1122.

Our review is based on four reports from the author: *Testing for Misunderstanding* (John R. Surber and Philip L. Smith, Educational Psychologist, 1981, 16, 3, pp. 165-174; *Technical Report No. 1, Structural Maps of Text as a Learning Assessment Technique: Progress Report for Phase I;* Surber, Smith, and Frederika Harper, undated, University of Wisconsin-Milwaukee; *Technical Report No. 6, The Relationship Between Map Tests and Multiple Choice Tests,* Surber, Smith and Harper, 1982, University of Wisconsin-Milwaukee.

These reports and papers describe the development of map tests as an assessment technique to identify conceptual misunderstandings that occur when students learn from text. The purpose is to diagnose student understanding in order to plan instruction. In this testing technique, the test developer graphically represents concepts and their interrelationships in a

map. Then, information from the map is systematically removed. Students complete the map shells. Four different levels of deletion associated with different types of content clues are described. Maps are scored by comparing the student-completed version to the original. Scoring involves looking both at the content included or omitted from the map and the proper relationship between this content. Report #6 describes scoring in more detail.

The authors did a series of studies on this technique, reported on in "Mapping as a Testing and Diagnostic Device." They found good interrater reliability and good consistency between developers of "master maps." They report on comparisons to multiple-choice tests.

Text maps and tests can be constructed in any content area at any grade level. The specific examples in these materials come from chemistry (matter), study skills, and sociology (the development of early warfare).

A manual, designed to teach students how to construct concept maps, is included in Report #1. The authors have given educators permission to copy these documents for their own use.

(AL#150.6MAPTES)

Taylor, Catherine S. *An Investigation of Scoring Methods for Mathematics Performance-Based Assessments*, undated. Available from: Catherine S. Taylor, Educational Psychology, 312 Miller Hall, Box 353600, University of Washington, Seattle, WA 98195.

The author compared three ways of scoring open-ended math problems:

- Task specific—assigning a specific number of points to a response depending on the presence of specified words, pictures, calculations, etc. The scoring guide for one item can't be used for the next, hence, "task specific."
- Holistic—one score for a performance-based rubric that can be used across similar tasks.
- Trait scoring—scoring several different dimensions of a performance with rubrics that can be used across similar tasks.

Results indicate:

1. Holistic scoring results in scores similar to task-specific scoring and the emphasis in both appears to be on conceptual understanding.
2. Trait scoring appears to focus attention more broadly and can tap into different elements of a students performance, depending on the features emphasized in the traits. (This author used two traits—conceptual understanding and communication.)

The author concludes that trait scoring may be more useful both instructionallly and for distinguishing different aspects of skill.

(AL#500.6INVSCM)

Thompson, Linda. *Portfolio Model*, 1994-95. Available from: Linda Thompson, Chief Moses Junior High School, 2215 Westshore Dr., Moses Lake, WA 98837, (509) 766-2661.

The author is experimenting with the use of portfolios in her seventh grade math classes. Students are asked to included in their portfolio at least one entry for each of: mathematics as problem solving, mathematics as communication, mathematics as reasoning, mathematics connections, estimation, number sense and numeration, concepts of whole number operations, whole number computation, geometry and spatial sense, measurement, statistics/probability, fractions and decimals, patterns and functions. A single entry might serve to illustrate more than one skill. Thus, the portfolio is designed to align with the NCTM standards.

The packet of materials includes the direction sheets for students, a sheet for each portfolio entry (revised in 1995 because students needed additional help selecting entries and reflecting on them), a self/peer rating sheet for group cooperation, a list of required content for a parent conference portfolio, the student version of a scoring guide for individual portfolio entries, and two activities designed to assist students to better understand and use the criteria (added in 1995). The scoring guide is holistic and uses a four-point scale where "4" is: "This response provides proof that you really understand the mathematical concepts you are demonstrating. You have communicated your understanding so well there is no question that you have mastered the ideas being explored." Thus, students are scored on conceptual understanding and communication; the packet contains no rubrics for problem solving, reasoning or connections.

The packet also does not include technical information nor sample student work. The author has given permission for educators to copy the materials for their own use.

(AL#500.3PORREM)

Thomas, William H., Barbara A. Storms, Karen Sheingold, et al. *California Learning Assessment System—Portfolio Assessment Research and Development Project—Final Report*, December 1995. Available from: Center for Performance Assessment, Educational Testing Service, Rosedale Rd., Princeton, NJ 08541.

The goals of the California Learning Assessment System (CLAS) portfolio component were to design a system that both supported California's instructional reform and provided trustworthy information about student performance in relation to state curriculum frameworks. In addition, to be effective, the system had to value the diversity of instructional

programs and portfolio projects in the state, to complement other components of the state assessment system, and be built on evidence of achievement from the ongoing work that students did in classrooms. The system is "non-prescriptive"—students and teachers select whatever work they feel demonstrates student achievement on California's content standards in writing, reading, and math. Thus, content in the portfolios varies greatly and must be assessed using general performance criteria that describe what quality work looks like on each dimension of the content standards to be included. In this case, there are criteria for the quality of composing/expressing (writing), constructing meaning (reading), communicating math, math content, and putting math to work. The report includes a description of the development process, rater consistency of resulting portfolios, results of a survey of teachers concerning the impact of participation in the project, and copies of the rubrics for each area assessed. No sample portfolios are included. According to the authors, the teachers reported that the experience of looking at students' assessment portfolios in terms of specific criteria for assessing broad dimensions of learning had a powerful impact on their understanding of what students can or should be learning and how they, as teachers, might support that learning. Note: Although CLAS is no longer operational, CLAS materials are generally of good quality and of use to others.

(AL#000.3CALLEA) A1, B1, C3, C4, D7, E6, F1, F4, F6, G4

Tittle, Carol Kehr and Deborah Hecht. *Mathematics Assessment Questionnaire: A Survey of Thoughts and Feelings for Students in Grades 7-9—Technical Report* and *Manual for Users*, 1990. Available from: Graduate School and University Center, City University of New York, 33 W. 42nd St., New York, NY 10036, (212) 642-2262.

The purpose of the *Mathematics Assessment Questionnaire* is to survey student thoughts and feelings about learning mathematics in classroom activity settings and to provide information that complements assessments of mathematical understandings. The questionnaire has 143 statements asking students about their awareness of self-regulatory thinking and skills, affective beliefs (interest, value, confidence, anxiety), and motivational and attributional beliefs. These are assessed in the context of three instructional activity settings: during class, working with other students, and homework.

The *Questionnaire* is available as part of a computer-based, classroom assessment package. The package includes student and teacher computer-based forms and a teacher guide. Both the teacher guide and the teacher computer program include instructional suggestions linked to each area of assessment.

(AL#500.3MATASQ)

University of Cambridge. ***AICE: An Introduction—Advanced International Certificate of Education*****, 1996. Available from: The AICE Coordinator, University of Cambridge, Local Examinations Syndicate, 1 Hills Rd., Cambridge CB1 2EU, United Kingdom, phone (international): +44 1223 553311, fax (international): +44 1223 460278.**

The *Advanced International Certificate of Education (AICE)* is an international pre-university curriculum and examination system. *AICE* is administered by the University of Cambridge Local Examinations Syndicate (UCLES). UCLES courses and assessments are available in mathematics and sciences, languages, and arts and humanities. These seem to be similar to advanced placement exams in the US.

The lending library has information about the courses and exams in English, Spanish, physics, music, art, and mathematics. Assessments use a variety of formats including on-demand essays and classroom-embedded portfolios. For example, the math assessment consists of 20 open-ended problems (four hours) assessed holistically for understanding, correct computation, strategies, and communication.

(AL#000.3AICEIN)

Vermont Department of Education. ***Vermont Mathematics Portfolio Project: Grade Eight Benchmarks*****, 1991. Available from: Vermont Department of Education, Vermont Mathematics Portfolio Project, 120 State St., Montpelier, VT 05602, (802) 828-3135.**

This document provides lots of samples of grade eight student work that illustrate different scores for each of the seven analytical traits used in the *Vermont Mathematics Portfolio Project*. Samples were taken from the 1991 portfolio pilot.

(AL#500.3GRAEIB)

Vermont Department of Education. ***Vermont Mathematics Portfolio Project: Grade Four Benchmarks*****, 1991. Available from: Vermont Department of Education, Vermont Mathematics Portfolio Project, 120 State St., Montpelier, VT 05602, (802) 828-3135.**

This documents provides lots of samples of grade four student work that illustrate different scores for each of the seven analytical traits used in the *Vermont Mathematics Portfolio Project*. Samples were taken from the 1991 portfolio pilot.

(AL#500.3GRAFOB)

Vermont Department of Education. ***Vermont Mathematics Portfolio Project: Resource Book*****, 1991. Available from: Vermont Department of Education, Vermont Mathematics Portfolio Project, 120 State St., Montpelier, VT 05602, (802) 828-3135.**

This document includes sample performance tasks taken from portfolio entries submitted by teachers as part of Vermont's 1991 math portfolio pilot project, a resource bibliography, and a list of suggested readings. The purpose is to provide colleagues with tasks that have worked well with students to promote problem solving. *This is meant as a companion document to the Teacher's Guide (AL#500.3TEAGUI).*

(AL#500.3RESBOO)

Vermont Department of Education. ***Vermont Mathematics Portfolio Project: Teacher's Guide*****, 1991. Available from: Vermont Department of Education, Vermont Mathematics Portfolio Project, 120 State St., Montpelier, VT 05602, (802) 828-3135.**

This document presents Vermont's current view of what should go into a mathematics portfolio, provides detailed information about the scoring criteria for portfolio entries and the portfolio as a whole, discusses how to develop tasks that will invite student problem solving, and provides help with how to manage the portfolios. *This is a companion piece to the Resource Book (AL#500.6RESBOO).*

(AL#500.3TEAGUI)

Webb, Noreen. ***Collaborative Group Versus Individual Assessment in Mathematics: Processes and Outcomes - CSE Technical Report 352*****, March 1993. Available from: Center for Research on Evaluation, Standards, and Student Testing (CRESST), University of California, Los Angeles, CA 90024, (310) 206-1532.**

The author reports on a study designed to (1) determine the extent to which information from group tasks can be used to make inferences about the abilities of individual students, and (2) determine what additional information about student skills is provided from group tasks.

The study used 53 seventh grade students who worked in small groups to calculate the costs of long distance phone calls. Two weeks later students worked individually on a similar problem. Work was scored on nine dimensions, e.g., "recognizes that call has multiple minutes," and "applies single cost to each additional minute." The nature of individual student behavior in the group was also analyzed, e.g., students (1) solved the problems correctly aloud with little or no assistance from others, and (2) expressed difficulty with the problems (made errors or asked questions indicating that they were confused).

Results showed that: (1) students working in groups showed uniformly high levels of performance; (2) some lower-achieving students did better when assessed individually than would be predicted from pretest scores, but only in cases when they used the resources of the

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group to understand the procedures; (3) however, in general, there was a large discrepancy between individual and group performance; (4) analyzing the group process skills of individual students shed considerable light on individual student understanding and on their collaborative skills; (5) students learn more from the group experience if they have been taught how to work productively in teams.

(AL#500.6COLGRV)

Webb, Norman, and Thomas A. Romberg. *Implications of the NCTM Standards for Mathematics Assessment.* Located in Mathematics Assessment and Evaluation: Imperatives for Mathematics Educators, Thomas A. Romberg (Ed.), 1992. Available from: State University of New York Press, State University Plaza, Albany, NY 12246.

This paper provides a good summary of the NCTM standards, both goals for students and standards for assessment. It uses four of the standards for assessment to develop criteria for assessments:

1. The assessment instrument should provide information that will contribute to decisions for the improvement of instruction.

2. The assessment instruments should be aligned with the instructional goals, the goals for the overall program, and a holistic conceptualization of mathematical knowledge.

3. The assessment instruments should provide information on what a students knows.

4. The results from one assessment instrument should be such that when combined with results from other forms of assessment, a global description is obtained of what mathematics a person or group knows.

The authors then illustrate their points with several assessment tasks that they feel would elicit the correct behavior from students. (These generally have only one correct answer and appear to be scored for degree of correctness.)

(AL#500.6IMPNCM)

Webb, Norman L. and Arthur F. Coxford, Eds. *Assessment in the Mathematics Classroom, 1993 Yearbook,* 1993. Available from: The National Council of Teachers of Mathematics, Inc., 1906 Association Dr., Reston, VA 22091.

This book contains a number of papers that discuss classroom assessment in grades K-12. Specific topics include student self-assessment, assessing problem solving, EQUALS, NCTM standards, and integrating assessment and instruction.

(AL#500.6ASSMAC)

Weiss, Iris R. ***The Status of Science and Mathematics Teaching in the United States—Comparing Teacher Views and Classroom Practice to National Standards.*** **Located in: NISE Brief 1, June 1997. Available from: National Institute for Science Education, University of Wisconsin, 1025 W Johnson St., Madison, WI 53706, (608) 263-9250 or (608) 263-1028, fax (608) 262-7428, Internet: niseinfo@mail.soemadison.wisc.edu**

This six-page document presents a summary of a survey of science and mathematics instruction in the US The student was done in 1993. Some interesting results were:

- "Traditional" lecture/textbook methodologies continued to dominate science and mathematics instruction. For example, 94 percent of high school science and mathematics classes listened and took notes during presentations by the teacher at least once a week, and 60 percent did so on a daily basis.
- Students are not given equal opportunities to achieve high expectations.
- More than 90 percent of science and mathematics teachers at the elementary and middle school levels, and 86 percent at the high school level, indicated that students learn best when they study these subjects in the context of a personal or social application. Similarly, most supported hands-on instruction, indicating that activity-based experiences "are worth the time and expense for what students learn." There was, however, less support among teachers for some of the other tenets of current reform ideas.

Actual survey questions are not included.

(AL#500.6STASCM)

Wessels, John D. ***A Model for High Performance Schools,*** **undated. Available from: Ten Sigma, 1610 Commerce Dr., North Mankato, MN 56003, (800) 657-3815, or (507) 389-6198, fax: (507) 389-1772**

This set of workshop handouts presents the TEN SIGMA model for restructuring schools. It contains good information about the project as well as:

- Setting cource goals
- Aligning assessment and instruction with these goals
- Rationalizations for integration assessment and instruction
- How to develop performance assessments
- Block scheduling
- Tips for handling the change process

- Balancing types of assessments

The handouts include sample goals for 3rd grade language arts and high school world history; sample rubrics for writing, bibliographies and civics (both task specific and general)

(AL#000.3HIGPES)

Wiggins, Grant. *Performance Assessment in Action: The Best Secondary Case Studies from "Standards, Not Standardization,"* and *Performance Assessment in Action: The Best Elementary Case Studies from "Standards, Not Standardization,"* 1997. Available from: The Center on Learning, Assessment, and School Structure, CLASS, 65 S. Main St., Building B, Box 2-10, Pennington, NJ 08534, (609) 730-1199, Internet: http://www.classnj.org

This excellent set of "do-it-yourself" development materials provides video clips of 12 classroom assessment situations and related activities tht develop and expand notions of:

- The characteristics of quality classroom assessment
- How quality assessment can help students learn
- Feasibility
- Student involved assessment
- Good criteria and where they come from
- How to set standards

Elementary and secondary case studies are provided in separate volumes. Case studies cover science, mathematics, social studies, language arts, and foreign language.

(AL#150.6PEASINs and AL#150.6PEASINe)

Wilkins, Cynthia. *Student Portfolio (Algebra)*, circa 1994. Available from: Northwest Rankin Attendance Center, 62 Terrapin Hill Rd. North, Brandon, MS 39042, (601) 825-2522.

This algebra or pre-algebra portfolio is intended to represent all that a student has learned during the year. The short document describes each entry (e.g., math autobiography, concept explanation, journal topic, specific skills, etc.) and emphasizes student self-reflection. Although point values for each entry are suggested, there are no criteria for assigning points.

It has been used for seventh and eighth graders taking algebra. Student directions are available.

(AL#530.3STUPOA)

Williams, Susan E., Hersholt Waxman, and Juanita Copley. *Calculator Mathematics Curriculum Assessment*, undated. Available from: University of Houston, College of Education, Curriculum and Instruction Dept., Houston, TX 77204, (713) 743-9870.

These observation checklists were designed to collect research data pertaining to the use of calculators in secondary mathematics classes. The instruments focus on the quality of calculator instruction. Student and teacher behaviors are recorded on a checklist about ten times per item per classroom period. General areas assessed included teacher/student interactions, environment, management of time and students, activities, materials, content, instructional strategies, and specific classroom applications of calculators. Assessment is administered by the researcher while observing teachers conducting mathematics lessons. Instruments are available for observing the use of fraction, scientific, and graphing calculators. At this time, the assessment instrument is in the exploratory stage, although it has been successfully piloted. This document includes only the observation forms; neither summarization and interpretation nor technical information is included.

(TC#500.4CALMAC)

Wilson, Linda D. *A Theoretical Framework Linking Beliefs with Assessment Practices in School Mathematics*, April 1994. Available from: University of Delaware, College of Education, Educational Development, Newark, DE 19716, (302) 831-2573, fax: (302) 831-4110.

This paper describes a "pure constructivist" notion of teaching, assessment practices that align with pure constructivism, and how consistent the NCTM assessment standards are with a notion of pure constructivism. The paper concludes that most current ideas of assessment in math, including the NCTM assessment standards, represent only "soft" constructivism and do not adhere to the strictest tenets of a constructivist notion of how students learn.

(AL#500.6THEFRL)

Zarinnia, E. Anne, and Thomas A. Romberg. *A Framework for the California Assessment Program to Report Students' Achievement in Mathematics*. Located in: Mathematics Assessment and Evaluation: Imperatives for Mathematics Educators, Thomas A. Romberg (Ed.), 1992. Available from: State University of New York Press, State University Plaza, Albany, NY 12246.

This paper takes the position that assessment affects instruction, and therefore, regardless of the other purposes for the assessment, the instructional implications of our assessments must

be taken into account. "If one acknowledges student learning as the central mission of schooling, it further suggests that not only the tasks, but also the system and structures for gathering accountability information and reporting the data, should be designed with instructional needs in mind."

Other points made by this paper are:

1. We need to change the view of math held by many teachers and the general public, that math is a set of rules and formalisms invented by experts that everyone else is to memorize. The authors maintain that both the test itself and the way results are reported will influence these perceptions.

2. Mathematical power means that citizens can use math to solve day-to-day problems. This means we need to seek evidence of students using, reflecting on, and inventing mathematics in the context of value and policy judgments. These experiences should be built into our instruction and assessments.

Implications for turning power over to students are also discussed.

(AL#500.6FRACAA)

Mathematics Bibliography

Index Codes

A—Type

1 = Example
2 = Theory/how to assess/rationale for alternative assessment
3 = Content/what should be assessed
4 = Related: general assessment; program evaluation; results of studies; technology; attitudes

B—Purpose for the Assessment

1 = Large scale
2 = Classroom
3 = Research

C—Grade Levels

1 = Pre K-K
2 = 1-3
3 = 4-6
4 = 7-9
5 = 10-12
6 = Adult
7 = Special education
8 = All
9 = Other

D—Content Covered

1 = General math
2 = Algebra
3 = Geometry/trigonometry
4 = Statistics/probability
5 = Precalculus/calculus
6 = Other
7 = All/Any

E—Type of Tasks

1 = Enhanced multiple choice
2 = Constructed response: short answers
3 = Long response/essay
4 = On-demand
5 = Project
6 = Portfolio
7 = Group
8 = Other than written
9 = Cognitive map

F—Skills Assessed

1 = Knowledge/conceptual understanding
2 = Application of concepts
3 = Persuasion
4 = Critical thinking/problem solving; reasoning/decision making
5 = Group process skills
6 = Quality of writing/communication
7 = Student self-reflection
8 = Process
9 = Comprehension
10 = Attitudes

G—Type of Scoring

1 = Task specific
2 = General
3 = Holistic
4 = Analytical Trait

DOE=Department of Education or
State Department of Education

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B1OR New Stand. Proj. (AL#000.3STUPOQ)
B1Pechman (AL#500.4MAPMAA)
B1Perlman (AL#000.3CPSPEA)
B1Psych. Corp.(AL#500.3AMAP-M)
B1Psych. Corp. (AL#500.3INTASM)
B1Psych. Corp. (AL#510.3GOALS)
B1Reese (AL#500.6NAEP96b)
B1Reg. Ed. Lab. Net. Prog. (AL#000.6TOOKIP2)
B1RI DOE (AL#500.3RHOISS)
B1Riverside Pub. Co. (AL#500.3CALPRL)
B1Ryan (AL#500.3TEAPEI)
B1Schwartz (AL#500.2ASSMAU)
B1Semple (AL#600.3PERASS)
B1Thomas (AL#000.3CALLEA)
B1Tittle (AL#500.3MATASQ)
B1Univ. of Cambridge (AL#000.3AICEIN)
B1VA DOE (AL#500.3GRAFOB)
B1VT DOE (AL#500.3GRAEIB)

B2Ann Arbor Pub. Schools (AL#500.1ALTASE)
B2Appalachia Ed. Lab (AL#600.3ALTASM)
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B2Bagley (AL#500.6ASSSTD)
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B2BC Ministry of Ed. (AL#000.3BCPERA)
B2Bellanca (AL#000.6MULASM)
B2Burns (AL#500.5MATLIT)
B2Burton (AL#500.5ADDSEK)
B2CA Assm. Coll. (AL#150.6CHACOU)
B2CA Math Council (AL#150.6CONASM)
B2Central Kitsap SD (AL#500.3STUFRG)
B2Charles (AL#500.6HOWTOE)
B2Clark (AL#500.3MCTPMA)
B2Clarke (AL#500.6CONASM)
B2Clarridge (AL#150.6IMPNEE)
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B2Cullen (AL#500.3ATTASS)
B2Curriculum Corp. (AL#500.3MATCUP)
B2Doig (AL#500.3ACTASM)
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B2Finston (AL#500.3STUASU)
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B2IOX (AL#500.6ASSMALv)
B2Katims (AL#500.3PACKET)
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B2Kulm (AL#500.6MATASW)
B2Lambdin (AL#500.3PLAPOA)
B2Lane (AL#500.3QUACOA)
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B2Lehman (AL#500.3PERASM)
B2Lesh (AL#500.6ASSAUP)
B2Macomb (AL#500.3MACINS)
B2Masters (AL#000.6DEVASA)

B2Math. Sci. Ed. Board (AL#500.3MEAUPP)
B2MD Assm. Consort. (AL#000.3PERAST)
B2Moen (AL#000.3LANCOS)
B2Nat'l Ctr. for Res. on Eval. (AL#150.6ASSWHCUs)
B2NC Dept. of Pub. Instr. (AL#500.3LINCUI)
B2Newmann (AL#050.3GUIAUI)
B2New Standards (AL#000.5NEWSTPm)
B2OR New Stand. Proj. (AL#000.3STUPOQ)
B2Paulson (AL#500.3PORGUP2)
B2Perlman (AL#000.3CPSPEA)
B2Pfeiffer (AL#500.3NIMGAP)
B2Pritchard (AL#500.3STUPOT)
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B2Schwartz (AL#500.2ASSMAU)
B2Secada (AL#500.4INTCOR)
B2Serrano (AL#000.3LOOPOA)
B2Sternberg (AL#500.3CHAMAP)
B2Stuart Fndn. Project Teachers (AL#100.3LANARS)
B2Thompson (AL#500.3PORREM)
B2VA DOE (AL#500.3RESBOO)
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B2Wilkins (AL#530.3STUPOA)

B3Appalachia Ed. Lab (AL#600.3ALTASM)
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C2Clarridge (AL#150.6IMPNEE)
C2Collis (AL#500.3COLROM)
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C2Cullen (AL#500.3ATTASS)
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C2Lawrence (AL#500.3UTACOC)
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C3Central Kitsap SD (AL#500.3STUFRG)
C3Clark (AL#500.3MCTPMA)
C3Clarridge (AL#150.6IMPNEE)
C3CLAS (AL#500.3SAMMAS4)
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C3Hartman (AL#500.3MATPOO)
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C3Thomas (AL#000.3CALLEA)
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C4CA DOE (AL#000.6STUSTS)
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C4Doig (AL#500.3ACTASM)

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C4Kloosterman (AL#500.3MEABEM)
C4Knight (AL#530.3HOWIUS)
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C8Wessels (AL#000.3HIGPES)

C9Katims (AL#500.3PACKET)

D1Alper (AL#500.3VARIMP)
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D1Baxter (AL#500.6MATPEA)
D1Beaton (AL#500.6MATACM)
D1Burns (AL#500.5MATLIT)
D1Clarridge (AL#150.6IMPNEE)
D1CLAS (AL#500.3SAMMAS4)
D1Collis (AL#500.3COLROM)

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D1Thompson (AL#500.3PORREM)
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D1Webb (AL#500.6COLGRV)

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E1CA DOE (AL#000.6STUSTS)
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E2Wessels (AL#000.3HIGPES)

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E3Guide to Maine (AL#000.3GUIMAE)
E3Hall (AL#500.3ALBGRN)
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E3Nat'l Ctr. for Res. on Eval. (AL#150.6ASSWHCUv)
E3NCSM (AL#500.2GRETAM)

E3New Standards (AL#500.3NEWSTM)
E3NY DOE (AL#000.6MATSCT)
E3OR DOE (AL#060.6FIRREP)
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E3Reg. Ed. Lab. Net. Prog. (AL#000.6TOOKIP2)
E3RI DOE (AL#500.3RHOISS)
E3Riverside Pub. Co. (AL#500.3CALPRL)
E3Ryan (AL#500.3TEAPEI)
E3Schwartz (AL#500.2ASSMAU)
E3Sternberg (AL#500.3CHAMAP)
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E3Webb (AL#500.6COLGRV)
E3Wessels (AL#000.3HIGPES)

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E4Alper (AL#500.3VARIMP)
E4Ann Arbor Pub. Schools (AL#500.1ALTASE)
E4Aurora Pub. Schools (AL#000.3SCIMAP)
E4Baxter (AL#500.6MATPEA)
E4Bellanca (AL#000.6MULASM)
E4Burton (AL#500.5ADDSEK)
E4CA DOE (AL#000.6STUSTS)
E4CA Math Council (AL#150.6CONASM)
E4CTB McGraw-Hill (AL#060.3CAT-5a)
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E4Ft. Hays Ed. Dev. Center (AL#500.3STAASM)
E4Hall (AL#500.3ALBGRN)
E4Hibbard (AL#000.6TOGSTC)
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E4Kulm (AL#500.6MATASW)
E4Lane (AL#500.3QUACOA)
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E5Clarke (AL#500.6CONASM)
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E5Finston (AL#500.3STUASU)
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E6Serrano (AL#000.3LOOPOA)
E6Thomas (AL#000.3CALLEA)
E6Thompson (AL#500.3PORREM)
E6VA DOE (AL#500.3GRAFOB)
E6VA DOE (AL#500.3RESBOO)
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E8Ann Arbor Pub. Schools (AL#500.1ALTASE)
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E8RI DOE (AL#500.3RHOISS)
E8Secada (AL#500.4INTCOR)
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E9Bellanca (AL#000.6MULASM)
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E10Ed. Testing Service (AL#500.6NAEPMAR)

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F1Beaton (AL#500.6MATACM)
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F1CA Math Council (AL#150.6CONASM)
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F1Hartman (AL#500.3MATPOO)
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F5CA Math Council (AL#150.6CONASM)
F5Cullen (AL#500.3ATTASS)
F5Finston (AL#500.3STUASU)

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F5Katims (AL#500.3PACKET)
F5Kulm (AL#500.6MATASW)
F5Leach (AL#500.3ALTFOE)
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F6Wessels (AL#000.3HIGPES)

F7Bagley (AL#500.6ASSSTD)
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F8Semple (AL#600.3PERASS)

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F10Pechman (AL#500.4MAPMAA)
F10Tittle (AL#500.3MATASQ)

G1Alberta Ed. (AL#500.3DIPEXP)
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G1Appalachia Ed. Lab (AL#600.3ALTASM)
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G1Doig (AL#500.3ACTASM)
G1Ed. Testing Service (AL#000.3MISALA)
G1Ed. Testing Service (AL#500.6NAEPMAR)

G1Guide to Maine (AL#000 3GUIMAE)
G1Hibbard (AL#000 6TOGSTC)
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G1Lawrence (AL#500 3UTACOC)
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G2Ann Arbor Pub. Schools (AL#500 1ALTASE)
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G2Univ. of Cambridge (AL#000 3AICEIN)
G2Wessels (AL#000 3HIGPES)

G3Ann Arbor Pub. Schools (AL#500 1ALTASE)
G3Bellanca (AL#000 6MULASM)
G3CA Math Council (AL#150 6CONASM)
G3Charles (AL#500 6HOWTOE)
G3CLAS (AL#500 3SAMMAS4)
G3CTB McGraw-Hill (AL#060 3CAT-5a)
G3Ed. Testing Service (AL#000 3MISALA)
G3EXEMPLARS (AL#500 3EXETES)
G3Hynes (AL#500 3K-5MAP)
G3Kulm (AL#500 6MATASW)

G3MD DOE (AL#000 3COMST)
G3Meltzer (AL#010 3SUROFP)
G3NC Dept. of Pub. Instr. (AL#500 3LINCUI)
G3NCSM (AL#500 2GRETAM)
G3Paulson (AL#500 3PORGUP2)
G3Perlman (AL#000 3CPSPEA)
G3Psych. Corp.(AL#500 3AMAP-M)
G3Psych. Corp. (AL#500 3INTASM)
G3Reese (AL#500 6NAEP96b)
G3Reg. Ed. Lab. Net. Prog. (AL#000 6TOOKIP2)
G3Riverside Pub. Co. (AL#500 3CALPRL)
G3Thompson (AL#500 3PORREM)
G3Wessels (AL#000 3HIGPES)

G4Ann Arbor Pub. Schools (AL#500 1ALTASE)
G4CA Math Council (AL#150 6CONASM)
G4Charles (AL#500 6HOWTOE)
G4Clarridge (AL#150 6IMPNEE)
G4Curriculum Corp. (AL#500 3MATCUP)
G4Ed. Testing Service (AL#000 3MISALA)
G4EXEMPLARS (AL#500 3EXETES)
G4Ft. Hays Ed. Dev. Center (AL#500 3STAASM)
G4Hall (AL#500 3ALBGRN)
G4Hartman (AL#500 3MATPOO)
G4Hibbard (AL#000 6TOGSTC)
G4Kulm (AL#500 6MATASW)
G4Lambdin (AL#500 3PLAPOA)
G4Leach (AL#500 3ALTFOE)
G4Lehman (AL#500 3PERASM)
G4Moen (AL#000 3LANCOS)
G4NCSM (AL#500 2GRETAM)
G4Newmann (AL#050 3GUIAUI)
G4OR New Stand. Proj. (AL#000 3STUPOQ)
G4Perlman (AL#000 3CPSPEA)
G4Psych. Corp. (AL#500 3INTASM)
G4Reg. Ed. Lab. Net. Prog. (AL#000 6TOOKIP2)
G4Thomas (AL#000 3CALLEA)
G4VA DOE (AL#500 3GRAFOB)
G4VA DOE (AL#500 3TEAGUI)
G4VT DOE (AL#500 3GRAEIB)
G4Wessels (AL#000 3HIGPES)

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